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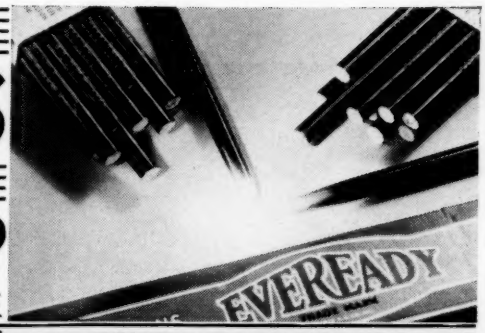

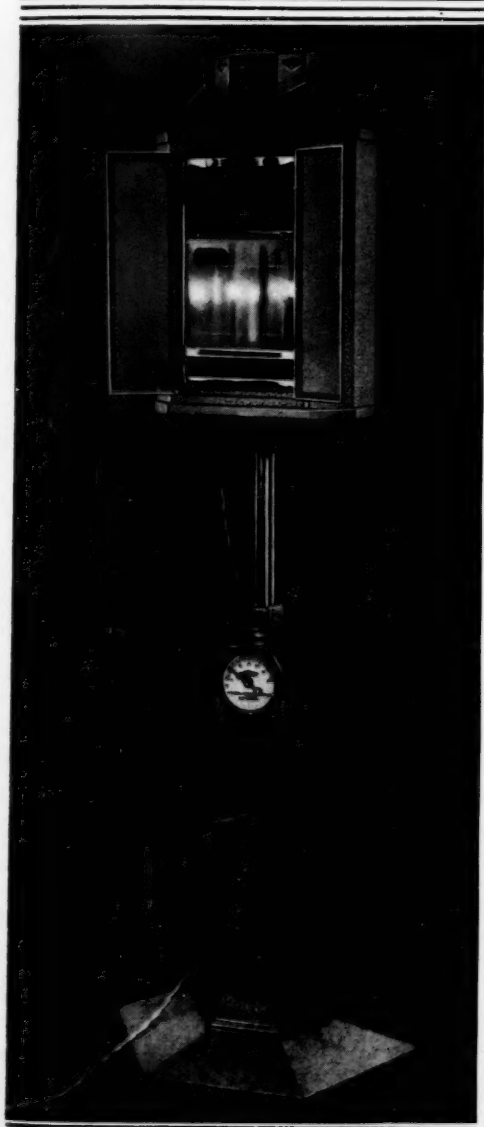

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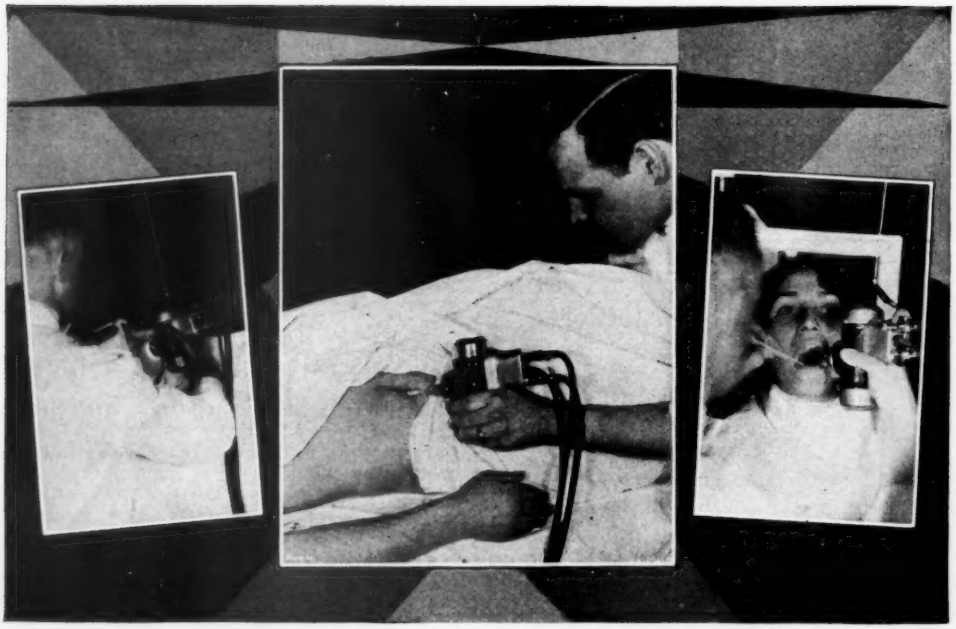

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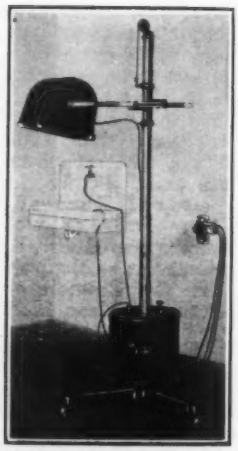

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ELECTRICAL EXAMINATION AND DIAGNOSIS IN NEUROLOGY*

THEODORE T. STONE, M. D.
CHICAGO, ILLINOIS

Electrical examination in many neuromuscular diseases affords at times great assistance in arriving at a diagnosis. This is true to a large degree only in the diseases of the lower neuron.

There are two currents generally employed, namely, faradic and galvanic. The faradic is an induced or interrupted current and it produces a tonic contraction of the muscle as long as the current is allowed to flow and stimulate the nerve. This current produces repeated induction shocks and acts as a sharp, quick, single stimulus. Because of this repeated sharp, quick stimulus in the faradic current, the muscle appears to be in a tetanic contraction under normal circumstances. A myographic tracing, however, would reveal its true character, i.e. repeated short, sharp and rapid contractions. The galvanic current is a constant one taken from a battery or wall plate. When a galvanic current is led into a motor nerve it is found as a rule that with all moderate strengths of current there is a stimulus to the nerve at the moment it is closed and another when the current is broken. (Du Bois-Reymond's Law of Stimulation.) The making of the current arises at the cathode or negative pole while the breaking of the current begins at the anode or positive pole. This is true for muscle as well as nerve. If cathode is nearer to muscle, the latent period of making contraction of muscle will be shorter than that of the breaking contraction while if anode is nearer to muscle, the reverse is true i.e. the latent period of making contraction of muscle will be longer than that of breaking contraction. It has been definitely proven by physiologists that when a current is passed into a nerve or muscle the changes at the two poles are different as shown by the differences in reactions and properties of the nerve at these points. Pfluger was the first investigator to study the changes of irritability and conductivity of nerves. He showed that when the galvanic current is not too strong there is an increase in irritability and conductivity in the neighborhood of the cathode while in the region of the anode there is a decrease in irritability and conductivity. Too, one must distinguish between ascending or descnding currents. Ascending currents are those in which the direction of the current in the nerve is away from the muscle, a position of the poles, therefore, in which the anode is closer to the muscle. In descending currents the positions are reversed. When the current is ascending the stimulus on making starts from the cathode, but cannot reach the muscle because it is blocked at anode where the conductivity is depressed. The stimulus on breaking takes place at the anode and the impulse encounters no resistance in its passage to the muscle. With the descending current the cathode lies next to the muscle and the making or cathodal stimulus of course causes a contraction On breaking, however, the impulse that is started from the anode is blocked by the depressed irritability in the cathodal region which comes on promptly with the galvanic current. At the moment of opening, a persistent tetanic contraction results instead of a single

*Read at the seventh annual meeting, American College of Physical Therapy, Chicago, October 10, 1928.

twitch. This phenomenon is known as opening tetanus or Rittler's tetanus and that occurring on closing the current is known as the closing of Pfluger's tetanus.

Normally every muscle reacts both to the faradic and galvanic current. The former as before stated elicits tonic contraction persisting as long as the current flows through the nerve and muscle while the latter produces a contraction with the cathode only when the current is turned on. This action is known as cathodal closing contraction. The anodal closing contraction is made by changing the electrode into an anode and increasing the current when a contraction of the muscle on making the current will result. For practical purposes, cathodal or anodal closing contractions are sufficient in determining or measuring the amount of neuromuscular degeneration. Thus it is seen that under normal conditions electrical excitation of the neuromuscular apparatus of the lower motor neuron, we have the normal tonic contraction with the faradic current and the short rapid like lightning contraction with the galvanic current. In this latter current polarization with quantitative and qualitative characteristics are important in that when a feeble current is used a contraction is seen at the moment of closure by means of the negative pole, i.e. cathodal closing contraction or C.C.C.; when the current is increased in strength the positive pole also provokes a contraction at the moment of closing as well as of opening i.e. anodal closing and anodal opening contraction, A.C.C., A.O.C. The anodal closing contraction is more frequent than the anodal opening contraction; on further increase in the strength of the current, a tetanus takes place, cathodal closure tetanus, at the moment of closing by means of the cathode. This condition is characterized by the muscles remaining in a condition of tetanic spasm as long as the current remains closed; finally there occurs a cathodal opening contraction C.O.C. and an anodal closing tetanus.

How are these currents applied? For an electrical examination one requires in the first place to know the so-called motor points or sites of election, i.e. those points at which stimulation of the nerves and muscles gives the maximum effect. These points are cutaneous areas at which the motor nerve lies very near the surface, or which correspond to the points at which the nerve enters into the muscle. The location of these cutaneous areas can be found in any good textbook on neurology

In testing out the nerves and muscles it becomes necessary to stimulate through the skin and the so-called unipolar method is employed. This method consists in placing one electrode, the active or stimulating electrode, over the nerve at the point which it is desired to stimulate, while the other electrode, the inactive or indifferent, is applied to the skin at some more or less remote part, usually at the back of the neck. The indifferent electrode is made large enough to cover several square centimeters of the skin, and one may conceive the threads of current as passing from it into the moist tissues of the body, and thence to the active electrode. As the threads of current condense to this latter electrode they pass through the motor nerve which lies under it, and if sufficiently intense will stimulate the nerve. The active electrode is small in size so that the current may be condensed and thus gain in effectiveness. The electrodes should be covered with cotton or chamois skin and kept moistened with a dilute saline solution so as to reduce the resistance of the skin.

Bipolar stimulation is also used and consists of keeping both electrodes on one muscle. Longitudinal reaction or descent of the motor point is used in nerve and muscle degeneration. This consists of placing the electrode away from the motor point towards the tendon. In this way more contraction of the muscle will result.

The significance of electrical examination consists of the determination of the ability of the nerve or muscle to become electrically stimulated. Under normal circumstances nerve or muscle will be stimulated by electrical current. In lesions of the lower motor neuron from the anterior horn cells to the end plate in muscle there is found an abnormal electrical reaction. This is known as the reaction of degeneration. It is extremely valuable in that it affords means of localization of a lesion. One can determine

the presence of degeneration in a group of muscles or nerves or in one muscle or nerve. Changes in a peripheral nerve can be elicited through this reaction. It affords diagnostic criteria in lesions of the cauda equina and upper localization of a tumor. In the differential diagnosis between a peripheral nerve disease and cut tendons at the wrist electrical examination is of importance.

What is the reaction of degeneration?

Reaction of degeneration is a term designating either a partial or complete impairment of the ability of a nerve or muscle to react to electrical excitation normally. The type of reaction i.e. either partial or complete is dependent upon the extent of the injury of disease to the lower motor neuron. The mildest form of impairment consists in diminution of electrical response to the faradic current and necessitates increasing the strength of this current in order to get a contraction at all. No contraction however, can be obtained with the faradic current if there is more marked nerve degeneration. This degree of nerve degeneration will give a good response with the galvanic current. Should the nerve degeneration be still more marked, greater amperage is necessary on using the cathode but the contraction is sluggish. Then further advanced degeneration will elicit no response to the cathode but will produce a contraction with the anode. Finally in a complete nerve degeneration no response with the galvanic current occurs except a slow vermicular wave-like contraction of the muscle when the muscle itself is stimulated. In other words there is found definite quantitative and qualitative changes in the electrical reaction in lesions of the lower motor neuron. More contraction will be produced if the electrode is moved away from the motor point toward the tendon.

A complete reaction of degeneration is characterized by the following symptoms:

1. The excitability of the nerves by the faradic current is abolished.

2. The excitability of the muscle by the faradic current is abolished.

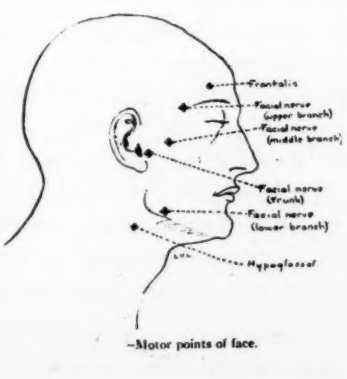
3. The excitability of the nerves by the galvanic current is abolished.

4. The excitability of the muscles by the galvanic current is modified in such a way that the contraction is slow and vermicular and that the anodal closing contraction is greater than the C.C.C., A.C.C., C.C.C.

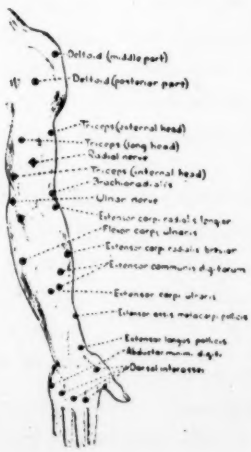
5. The chronaxia value is markedly increased.

What produces this type of electrical response? It may be said to be present in all lesions of the lower motor neuron which are as follows:

(A) Severe affections of the peripheral nerves.
  (1) Traumatic
    (a) Section of nerve
    (b) Severe bruising of nerve
    (c) Pressing on nerve
    (d) Stretching of nerves as in Brachial Plexus Paralysis
  (2) Rheumatic
    (a) Facial paralysis



Motor points of face.



Motor points of upper extremity, anterior view

(3) Toxic and infections
  (a) Lead paralysis
  (b) Alcoholic
  (c) Arsenical
  (d) Infective forms of multiple neuritis such as Diphtheria, etc.

(B) Anterior Horns
  (1) Acute anterior poliomyelitis
  (2) Subacute and chronic poliomyelitis
  (3) Spinal form of progressive muscular atrophy
  (4) Amyotrophic lateral sclerosis
  (5) Spinal gliosis
  (6) Diffuse cervical and lumbosacral myelitis with involvement of the grey matter
  (7) Diseases of the nuclei of the bulbar nerves corresponding to those of the anterior horns.
    (a) Progressive bulbar paralysis
    (b) Acute inferior polioencephalitis
  (8) Myatonia congenita.

(C) Anterior Roots
  (1) Compression from tumors.
  (2) Compression from disease and thickening of the meninges about the roots
    (a) Cervical hypertrophic pachymeningitis
    (b) Syphilis
  (3) Compression in the intervertebral foramina in diseases of the spinal column
    (a) Caries of spine
    (b) Tumors of spine
    (c) Fracture of spine
    (d) Dislocation of spine.

When is this change in the electrical excitability found? In lesions of the lower motor neuron, it takes about ten days to two weeks for the nerve to degenerate so that normal electrical responses as described above are present despite disease. In fact the electrical response may be that of a slight increase in irritability. After ten to twelve days the nerve degenerates and there results definite interference with the normal electrical reaction. Incomplete reaction of degeneration is to be found only in isolated cases of primary muscular diseases such as dystrophies and trichinosis.

Other more uncommon forms of changes of electrical irritability are:

(1) Myasthenic Reaction of Jolly. This consists of gradual exhaustion and cessation of response to faradic stimulation. It is a fatigue reaction. If the muscle is allowed to rest, the contraction reappears on stimulation with the faradic current. Myasthenia gravis is the disease in which the reaction occurs.

(2) Erb's myotonic reaction which consists of a series of wave-like contractions on galvanic stimulation and persistence of the contraction for a few seconds after cessation of stimulations with the faradic current. Myatonia congenita (Thomson's Disease) shows this reaction. It may occur also in atrophic muscles for example myotonia atrophica or syringomyelia.

(3) Erb's sign consisting of heightened electric excitability of the motor nerves with galvanic current. A weak current of .1 milliampere may induce a contraction. This is found in tetany.

(4) Cadaveric reaction seen in family periodic paralysis during the acute stage consists of total loss of electrical response.

The prognostic value of electrical stimulation is dependent upon the completeness or incompleteness of the reaction of degeneration. We know that it takes from 10 days to 2 weeks for a nerve to degenerate and any muscular response obtained before that time has no prognostic significance. If, however, after this period, faradic stimulation still elicits contraction, recovery will be rapid i.e. within three to six weeks. If there is no faradic response and a diminished galvanic reaction recovery may be expected within six months. If qualitative changes are present that is polar inversion, the outlook is less favorable. Finally in the case of complete reaction of degeneration, recovery is either incomplete, possibly with subsequent contractures. Recovery if it occurs will take a year or two. In the case of regeneration the electrical responses return in the following way: first there is a mild contraction on stimulating the motor point with the galvanic current, then there is disappearance of polar inversion and finally there is response to the faradic current.

A record should be kept of all the nerves and muscles examined. This record should con-

sist of the quantitative and qualitative response to the faradic and galvanic currents. A copy is represented in the diagram. The muscles tested, the strength and kind of current should also be recorded.

Chronaxia is a term given to a new method for the diagnosis of the degree of muscle nerve degeneration. In this method one uses the principle of induction shocks or pendulum interrupters. This method has been made available recently by Lapicque,[1] the French physiologist, and his pupils. This term essentially means the minimum duration during which a current of a certain defined strength must flow through a muscle nerve in order to produce muscular contraction. Rheobase or rheobasic voltage is the current strength chosen by Lapicque as the basis for the measurement. This latter term is defined as the minimial stimulus required to produce a muscular contraction with the galvanic current, when traversing current is allowed to act for an indefinite time. If a current is used whose voltage is twice the rheobasic strength, the muscle nerve shows a sudden marked increase in the magnitude of the contraction. This reaction seems apparently to be characteristic of all muscle nerves and the amount of twice the rheobasic value is constant. We know that muscle-nerves or groups of muscle nerves have different chronaxia values and these values are increased as compared with the normal values which varies from 0.0001 to 0.0007 second; as the injured nerves regenerate the values decrease so that according to the obtained readings one may determine the index of the rate of recovery.

The student interested in the actual mechanism of this exceedingly new contribution is referred to Lapicque's original article. Suffice it to say that essentially this method is measured by the use of electrical condensers. Condensers are apparatuses for accumulating electricity and from which the electricity so stored can be totally discharged almost instantaneously. The formula used is T. RC k; where T is the time chronaxia, R, the resistance of the circuit, C, the capacity of the condenser at the rheobasic voltage and k, the experimental constant.

For practical purposes the method consists essentially of first obtaining the rheobasic voltage of the particular nerve tested. This is done by noting the minimial voltage required to elecit a minimial contraction with a galvanic current. The double of this voltage is the rheobase. The next step is to charge a series of condensers of varying capacities (.01 microfarad to 50 microfarads) with this current voltage, and then, beginning with the condenser of smallest capacity, one proceeds to discharge them one after another across muscle nerve stimulated until a contraction is obtained. The condenser of least capacity necessary to produce a contraction indicates the nerve chronaxia.

A few practical examples to illustrate how the value of electrical examination must be analyzed would not be amiss at this time.

A man brought into the hospital with a history of having received a gunshot wound in the forearm in which the extenser carpi ulnaris muscle is injured. He is unable to extend the hand. Electrical examination reveals that the extenser carpi ulnaris muscle contracts but the hand does not raise. Does this mean that the nerve is injured? No, it means that the tendons at the wrist have been severed.

A man, 35 ears of age, suddenly falls and is unconscious. Examination reveals a right hemiplegia with a normal electrical reaction. Does this mean that this man will get well? No, in the first place this is an upper motor neuron lesion involving the pyramidal tract and electrical examination in diseases of this tract never shows any changes. Therefore electrical reactions or responses bear no relation to the prognosis.

A patient is seen who gives a history of a gradual onset of paralysis of the lower extremities accompanied by pain and tenderness. Electrical examination reveals a reaction of degeneration. In the presence of tenderness along nerve trunks, atrophy and absent deep reflexes and sensory changes, this electrical reaction is of help in diagnosing multiple neuritis.

A woman is brought in with a peripheral paralysis of the right seventh cranial nerve (Bell's Palsy). The surgeon wishes to know whether surgery is indicated. The electrical response with faradism shows a definite con-

traction of the muscles (facial muscles). Certainly with this faradic reaction it can be said that this patient will get well in a period of four to six weeks. Surgery is not indicated.

A patient, a boy of eleven years of age, with anterior poliomyelitis is referred for treatment with faradic current. This is improper because in anterior poliomyelitis a reaction of degeneration is present and neither the nerve nor muscles involved react to faradism. Galvanism alone may be used.

REFERENCES

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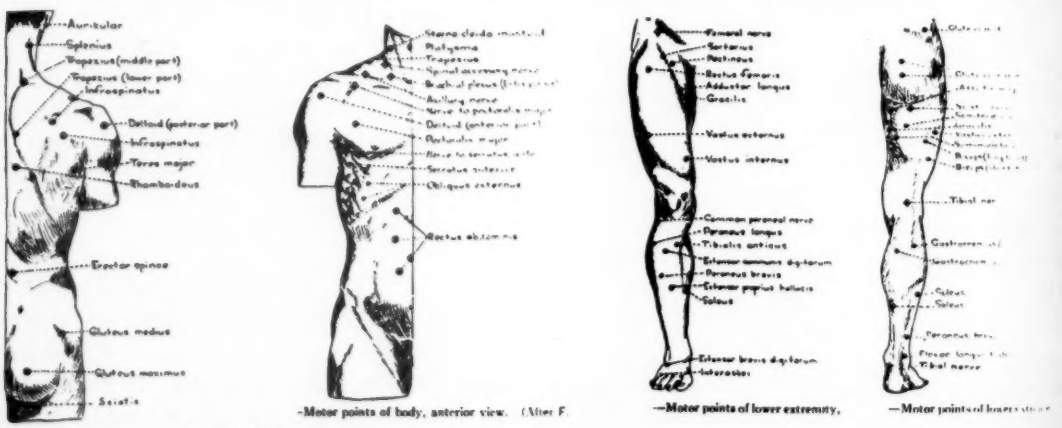
DISCUSSION

DR. DISRAELI KOBAK (Chicago): Dr. Stone has given us a paper full of practical suggestions of value



Motor points of body, posterior view. (After Erb.)

Motor points of body, anterior view. (After F

Motor points of lower extremity.

Motor points of lower extremity.

both to the specialist in neurology and the general practitioner. Electrodiagnosis is a method very much neglected by the average physician and this in spite of the fact that not infrequently it is the court of last judgment where specific and refined diagnosis is indicated, or where important medico-legal testimony is involved. Ever since the time of Duchenne and Charcot the neurologists have appreciated the value of the faradic and the galvanic current, and have exploited these measures most intelligently. There is nothing superior or the equal of these agencies in the diagnosis of peripheral nerve lesions, traumatic neuritis, certain forms of hysteria and the differentiation of the true from the malingering types. The quality and the quantity of reaction is of great value not only as a point in diagnosis but also in prognosis. The reversability of the polar reaction is an index of great importance, a point that has been well emphasized by the speaker. However, it is hardly necessary to say that the method is not as simple as one would be led to believe when listening to Dr. Stone who has made a special study of electropathology. Only in the hands of those well informed with the neuro-anatomical structures can these measures be considered pliable. And this is an important point to remember because the reliability of the interpretation depends upon the fact that the physician employing these tests must be well oriented in following directions. The neuro-anatomical structures electrophysic and the technic of the agency utilized.

A record of all observations made on the patient throughout his disability is important. Only by such a record can the physician or specialist arrive at a true analysis of the progression, retrogression or the changes that may take place in the affected part. The therapeutic value of the faradic and the galvanic currents must not be forgotten. The neuromuscular responses that one evokes has a nutritional value par excellence. Intelligent electrical stimulation is the best method, and its cautious measurable and persistent application is a restorative measure of greatest value.

DR. V. E. GONDA (Chicago): This paper is indeed a most thorough presentation of our present knowledge on electrodiagnosis. With reference to it as a means of prognosis there is a need for detailed investigation because the neurologists are by no means agreed that it follows the classical effects of polar reversibility. In the past few years I have seen cases of facial paralysis that showed no reaction to degeneration and who did not make the expected early recovery. Now this is contrary to orthodox teaching but as teachers we frequently see cases that react contrary to rule. It is not an unusual experience to see single or muscles groups recover their motility quicker than the change in the electrical reaction. I have in mind a case of facial tic in which we injected a 40% solution of alcohol. Within four months the facial muscles became normally active but the electrical reaction showed complete degeneration. On what basis can Dr. Stone explain this paradox? What in his opinion is partial reaction to degeneration? On these questions the text books are confusing and it is vitally important for the students and investigators to come to a common understanding.

DR. SIGMUND KRUMHOLZ (Chicago): I agree with Dr. Stone that galvanic as well as faradic currents are a great help in the diagnosis of neurological diseases. That is especially true in the diseases of the lower motor

neuron including the cells, and anterior horn cells, as well as of the peripheral nerves.

When I started out in practice and found that I needed these electrical machines for purpose of diagnoses, I discovered that it was necessary for me to learn how to use these instruments. It is one thing to read about them and listen to papers on the subject, but it is quite another thing when it comes to their actual use. It is as difficult to manipulate and interpret the results as it is for the beginner to interpret auscultation and percussion. It takes perseverance and patient training, but eventually this may be accomplished.

In contra-distinction, you will say that the response as in a normal muscle, the degenerated muscle or nerve is apt to be slow and worm-like. One must see the difference because it is not so gross. It is, in fact, very delicate, and it requires experience to see the difference and to interpret the changed phenomena.

I divided the cases that I examine with these instruments. One group is the definite type, which is easily diagnosed; the other, the border-line variety. The cases which are easily diagnosed are those like Bell's facial paralysis, or any other definite paralysis of the nerves. In those cases I find it convenient to be able to prognosticate the status of the disease for the patient. I do not know of anything that helps me more to make a prognosis, as for example, of a facial paralysis, than that of the galvanic current. Bell's palsy which originates in the internal facial canal or the facial canal is apparently of good prognosis, and differs from that of the facial which is of a deeper origin. Loss of sensation for taste is infrequently a concomittant phenomena. I found that tests for taste sensations, after paralysis, lasts for a few weeks and are very unreliable. Taste is not easily tested, and therefore when I find that my electrical response, as Dr. Stone pointed out, is present to the faradic current, I can say that the prognosis is good. On the other hand, if I find that there is reversion to the polarity, I can say that the prognosis is pretty bad, and that the patient will probably not recover for a year or two, if at all. He may have contractions, especially so if I find that there is no response to the galvanic current. It is most important that the electrode is on the nerve point and not on the muscle, because even though you have a complete reaction to degeneration the muscle will react—will respond to the current; and not only will it respond but it may even respond more strongly. Remember, when you get reaction to the degeneration you are not dealing with quantity but with quality.

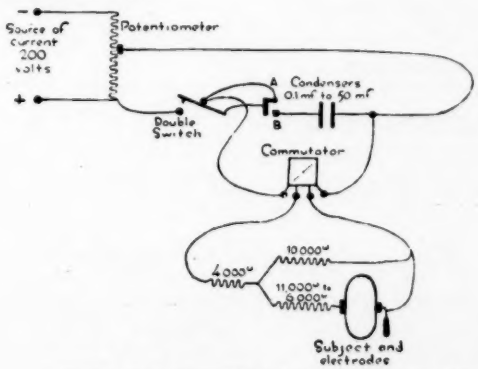
There is another group of conditions that I feel this electrical current is very important in and that is the medical-legal and emergency cases.

From time to time we have patients sent to us from some casualty insurance company, for example, to inform them as to the permanancy of the injury of a nerve, or the recovery of the patient, etc. I do not know of any better way to determine whether the injury is going to be permanent, that is, whether the nerve or nerve trunk is completely degenerated, or whether it is only partially involved, than the way Dr. Stone pointed out.

On the witness stand lawyers will use every method to find out how much and how far you have examined your patient. Many of them know all about the fact that there is an electrical apparatus for testing of nerves in paralysis, so it is well to examine every case where there is a question of paralysis of the nerve, true or false, and very often it turns out not a true paralysis.

There is a large percentage of patients who claim that they have paralysis, which is nothing more than a traumatic neurosis. I think it is really a form of malingering. These patients may or may not think that they are paralyzed. They show normal electrical reaction, no atrophy, and are usually quickly cured by a financial settlement.

Dr. Theodore T. Stone (Closing): Figures 1 to 7 illustrate some points made in my paper and the type of records kept by us. Figures 1 to 6 show the motor points as they can be found in any text book. You see the various branches of the facial nerves anterior and posterior view of the nerves of the upper and lower extremities.



—Electrical circuit for measuring chronaxie with condensers. (From

Figure 7 shows the electrical circuit for measuring chronaxia. It shows the modus, various condensers collecting together and the stimulus thrown in at one time. It shows the minimum amount of stimulation in the minimum amount of time. It shows the comparison factors for the strength of current and the duration of the current.

Table 8 is a record we use at Northwestern University, Department of Neurology, to determine what muscles are degenerated and what are mildly or moderately or partially involved.

You will notice in this figure we have the extensor digitorum communis showing no response. The quality of the current is slow for the deltoid, rapid in the supinator longus, slow contraction here on the extensor digitorium communis and in the extensor pollicis longus.

With records of this kind, you can see that they will be of tremendous value in cases where there are indications of paralysis.

I think it is very important for everyone who does medico-legal work in court rooms. As I said before, in electrical examination or examinations of diseases in the upper motor neuron, this method is valuable. You can determine if a man is malingering and if you do that by this examination you have a perfect right to say that it is malingering.

We have seen men who have complete reactions get well. We also have seen cases of complete reaction of degeneration and they are not well within six weeks but have gotten well in six months. We have found in our experience that galvanic current is of the utmost importance. In fact, as Dr. Kobak said, it is one of the best currents we have for this treatment.

	FARADISM	GALVANISM				
Muscles		C.C.C.	C.C.C.	A.C.C.	A.O.C.	C.O.C Quality
Deltoid						Slow
Supinator Longus						Rapid
Extensor Digitorium Communis	No Response					Slow Contraction
Flexor Carpi Ulnaris						
Flexor Carpi Radialis						
Abductor Pollicis Brevis						
Extensor Pollicis Longus	No Response					Slow Contraction
Interossei						

Dr. Kobak mentioned something about the betterment of these conditions. I am going to say to him that up until now I have been sending him some of my cases advising him what I thought ought to be done, and I think he knows more about it than I do. I say this though: for all cases of nerve or muscular diseases where you have a complete reaction of degeneration it certainly reduces itself to one thing: that you must treat that patient with he current that will produce a contraction, because in these cases of reaction of degeneration the faradic response is such that the galvanic or some form of galvanic current is the type to use. In the early cases involving the nutrition of the muscles, where the condition of the muscle is such that the strong current given over a long period of time will be beneficial, the thing to do is to start with a gradual amount of galvanic or some form of galvanic current for a certain time and later on increase that current to two or three times a week.

As to the question of partial reaction of degeneration in our opinion and experience, that class of individuals comes in with the neuron or muscular cases. By that we mean that it may be anything from a decreased amount of reaction to faradism; that is, if you take a normal individual and stimulate him with the faradic current you get contraction. If you take an individual who has a facial paralysis and stimulate him with that same amount of faradic current for the same length of time you will find that there will be no contraction; by increasing the faradic stimulation you will get a contraction anywhere from that point of increase of the faradic current until we have a change in the muscle by galvanic current, and we understand that is classified as partial reaction of degeneration.

The real or absolute reaction of degeneration only means a slow, worm-like contraction of galvanism within the muscle itself where the muscle is stimulated and not the nerve.

55 E. Washington Street.

A CRITIQUE OF PHOTOTHERAPY*

FRANK THOMAS WOODBURY, M. D.
LIEUT. COL. U. S. ARMY RETIRED

Considering the present status of phototherapy, certain outstanding features may be clearly discerned.

1. Through the slovenly disregard for accurate nomenclature a great deal of otherwise valuable material is hopelessly lost in the fog of meaningless terms.

2. The emphasis laid on the physical aspect of radiant energy has been allowed to color the physiological and the therapeutic view. Particularly, the senseless repetitive emphasis on infra-red, visible and ultraviolet.

3. The persistent propaganda of commercial firms has built up a sales resistance against newer ideas or different interpretations which might affect sales volume thereby tending to confuse and to over-emphasize matters of no clinical importance.

4. A great many facts already accumulated have not as yet been accurately sorted out, classified and evaluated. They often appear in the literature as a learned dressing for ideas otherwise unconnected and of little value.

5. A number of writers have rushed into print without having carefully digested all the available facts and without a balanced understanding of the relation of physical and physiological reactions to therapeutic indications. As a result they have afforded material comfort to the scoffers and discredited otherwise serious labor.

Time is too short to enter into a rectification of these various errors. Let us rather, for the sake of clarity, disregard all that has been said or written so far except facts and let us rearrange these facts into a simple and understandable system.

Read at the Seventh Annual Meeting of the Am. College of Physical Therapy, Dec. 12, 1928.

Phototherapy defined. The therapeutic application of radiant electromagnetic energy from heated sources is called phototherapy.

For electromagnetic radiant energy to be effective therapeutically, two factors are essentially interdependent. First, the radiant energy must be converted into photochemical, photoelectrical and photothermal energy within the substances of living cells. This is called absorption. Second, the reaction engendered thereby must be of a degree sufficient to possess therapeutic value.

This being evident and established, the practical phototherapeutic spectrum becomes limited to the region between 250 $\mu\mu$ and 1.4 μ.

It happens that the longer wave portion of this region is predominantly photothermal. The peak of the curve of heat penetration is at about 770 $\mu\mu$. It rapidly subsides to zero at 1.4μ but more gradually to zero at 170 $\mu\mu$. (See chart.)

Radiation having its maximum energy in the neighborhood of 770 $\mu\mu$ or lying between 500 $\mu\mu$ and 1.4 μ may be considered to have predominantly photothermal effects. Treatment with caloric rays is photothermy. The photochemical and photoelectrical effects, of which photoluminescence is a part, are markedly restricted to the area between 250 $\mu\mu$ and 500 $\mu\mu$. Treatment with these rays is collectively classed as actinotherapy. The rays are all absorbed by the skin, mostly in the first few millimeters.

When actinic and caloric radiant energy are present in the same ray, the physiological effects of both are blended. Treatments with these are called heliotherapy and artificial heliotherapy.

The actinotherapeutic spectrum as a whole produces a large number of physiological effects which are, for the time being, grouped under the general head of actinic effects. These ef-

fects may be both local and general. While we lack facilities for producing radiations of specific wave lengths to produce distinct physiological effects yet within the actinotherapeutic spectrum certain restricted areas have been found. which produce well marked primary as well as secondary effects, as follows:

The radiant energy between 250 μμ and 313 μμ causes dermatitis in unpigmented persons. The maximum effects occur between 297 μμ and 313 μμ. The region between 280 μμ and 330 μμ causes pigmentation but only in those who will develop pigment. In non-pigmenters it causes dermatitis with chloasma and lentigo, hydroa, keratosis senilis, eczema, xeroderma, pigmentosa, cheilitis and cancerous dermatitis [1]

The region between 291 μμ and 313 μμ activates cutaneous ergosterol creating vitamin D.

The region between 250 μμ and 360 μμ causes marked flluorescence of the skin and its appendages, the eyes and teeth, which is visible only in the dark.

With the exception of fluorescence, these several effects are not dependent upon each other, as it is possible to cause pigmentation without dermatitis, vitamin D activation without either pigmentation or dermatitis and, if a certain exclusive region be employed, we can cause dermatitis or pigmentation without activating vitamin D. (See chart.) It is possible for exhibition purposes, to obtain radiation lacking the wave lengths which produce these effects, but apparently similar otherwise.

ACTINIC DERMATITIS

Possibly the most overworked and least understood term in phototherapeutic literature is erythema. It has been continually misused for dermatitis. To illustrate—the following table of differences is herewith presented.

Erythema

The maximum erythema is produced in the region of wave length 770 μμ. It is an active hyperemia without histological changes.

Occurs at once, is continuous during irradiation, and ceases shortly after irradiation ceases.

Is accompanied by increased visible perspiration.

Is just as pronounced in pigmented skins as in white skins.

Is never followed by pigmentation.

Is not limited to the areas irradiated.

Is attended by a sense of warmth, not unpleasant, and by systemic reaction marked by increased metabolism and fall in blood pressure. Fever is reduced.

Systemic infections are improved.

Indirectly germicidal in deep tissues.

Is useless or contra-indicated in many chronic skin diseases.

Only one degree of intensity is clinically recognized.

No histologic changes occur. Tissue returns to normal after erythema subsides.

Finally, erythema will prevent, relieve or cure a dermatitis.*

Actinic Dermatitis

The maximum actinic dermatitis is produced by 297 μμ.

Paresis of blood vessels with passive dilatation, hyperemia with stasis diapedesis, exudative thrombosis, and destruction of blood vessels occurs.

The exudation and diapedesis produce oedema, swelling of epidermal cells, their separation by blister with reformation of histological units and some alteration of characteristics.

Occurs at once after irradiation and continues for a varying period of days after irradiation ceases. It is seen only by ultraviolet irradiation in the dark for a period known as the incubative period after which it becomes visible to light.

Perspiration is checked.

Occurs with increasing difficulty as pigmentation increases.

Is followed by pigmentation in persons who normally form pigment.

Is sharply limited to the area irradiated.

Is attended with exquisite tenderness, burning pain, intolerable itching and often a systemic reaction, due to sympathetic nerve irritation, frequently attended by fever and visceral congestion.

Systemic infections are made worse.

Directly germicidal on surface of tissues only. Indirectly germicidal superficially.

Is indicated especially for chronic skin diseases.

Four degrees of intensity are distinguishable and producable clinically.

Histological changes occur, but only in most superficial layers of the skin. These are marked by a formation of the new blood vessels, of pigment, in some cases, and of paresis of cutaneous capillaries long continued after pigmentation has faded.

Actinic dermatitis over a large area causes serious systemic disturbance marked by visceral congestion.

Actinic dermatitis cannot be produced satisfactorily in skins which are well pigmented either racially or by previous actinic irradiation or by artificial coloring nor, when they are coated with ointment, scabs, blood, or hair. Closely meshed fabrics, window glass and some filters prevent dermatitis. Actinic dermatitis may be caused by wave lengths not usually able to produce it, but only under the same circumstances as above, when substances which fluoresce under the longest actinic rays are either swallowed or painted on the skin, the so-called photodynamic effect.[3]

For these reasons, the terms erythema and erythema dose are highly incorrect in actinotherapy. Actinic dermatitis, giving the degree, is the correct expression.

Actinic Dermatitis as a Therapeutic Procedure

As a therapeutic measure, actinic dermatitis is restricted to three distinct indications: (1) replacement of chronic pathological tissue by normal tissue, (2) the sterilization of superficial infections by the resultant passive hyperemia, and (3) counterirritation. The indications apply also to an analogous effect upon mucous membrane.

For these indications a fourth degree dermatitis dose is perfectly proper and often necessary.

In the treatment of systemic disease, however, actinic dermatitis is not only useless but it is distinctly contra-indicated because of the induced visceral congestion. It is therefore a grave and at times fatal complication in such diseases as uremia, tuberculosis with pulmonary foci, diabetes mellitus, gastro-intestinal diseases attended with ulceration as a possible complication, and is to be avoided in the infant, the cardic case, the thyrotoxic case, the menstruating, and the pregnant. It is often quite a serious accident to those perfectly well. Actinic dermatitis is not therefore an invariable or universal therapeutic measure but is to be confined do dermatological conditions in non-pigmenters strictly.

Therapeutic agents whose claim to usefulness is based upon their ability to produce an actinic dermatitis are thereby restricted to dermatology since other agents which do not produce dermatitis and are highly effective remedially are preferable for systemic actinotherapy.

It is very difficult to overcome the fallacy that dermatitis is the essence of actinotherapeutic treatment.

It is equally difficult to replace this fallacy with the truth that highly valuable therapeutic actinic effects are obtainable in all systemic diseases and also locally on skin, conjunctiva and mucous membrance without producing an inflammatory reaction.

For this reason we must dispute with vigor and assurance that an agent though producing actinic rays is valueless because it is too weak to produce a dermatitis. How can an inflammation of the skin indicate the degree of systemic response in any one of a hundred different physiological reactions due to irradiation by spectra having different qualities?

Most unfortunately this very obvious actinic dermatitis has been seized upon by many as a ready to hand indication of dosage. But I maintain that it is an indication of dosage for dermatitis only for the individual who is to be treated.

What is the dermatitis dose per sq. cm. of skin for rickets, for osteomalacia, for mucous colitis tuberculous arthritis, for diabetes, for hay fever, for noma? In a blonde, a brunette, a mulatto, a negro?

From a mercury arc, a tungsten arc, a reinforced carbon arc? The idea is ridiculous in the light of what we have just considered. Then again the dermatitis spoken of is a visible reaction. How about the latent dermatitis made visible only by contrast in the dark with a skin made flluorescent by ultraviolet rays?[4] Suppose the dermatitis remains latent and never becomes visible? I therefore maintain that dermatitis is not a standard for actinotherapy in treatment or dosage except in skin diseases.

ACTINIC PIGMENTATION

Without going into the chemistry of actinic pigmentation which is the same as racial pigmentation but which, according to Laurens[5] occurs extracellularly, we have certain pertinent facts to consider. It is produced by radiant energy between 280 and 330 $\mu\mu$. Pigmentation of any kind converts, into photothermal energy, radiant energy which would otherwise be absorbed as photochemical, photoelectrical and photoluminescent energy.

Pigmentation is formed only by those very wave lengths against which it is a protection: the best possible evidence is furnished by nature herself, that actinic dermatitis is undesirable.

Actinic pigmentation is not formed in the skins of blondes, especially red blondes, nor of albinos, nor will it form in the patches of leukoderma. Blondes survive only through protective clothing. When exposed nude they always develop a dermatitis and it is the general experience that such persons when suffering from systemic complaints, especially tuberculosis, do badly with actinotherapy unless the irradiation is given most cautiously in broken doses too mild to cause a dermatitis, or unless the skin be artificially dyed a protective tint.

The tint of actinic pigment depends upon the source and quality of the rays. Actinic pigment unlike racial pigment is not permanent. It fades more or less quickly when irradiation ceases. No change in health is noted due to this fading. Patients who have gained a deep pigmentation while undergoing actinotherapy do not necessarily relapse when the pigmentation is allowed to fade at the termination of the cure.

Neither does clinical improvement correspond with the degree of pigmentation because this depends upon the presence of pigment forming wave lengths in the radiant energy employed. So long as that spectrum includes the wave lengths actinotherapeutically valuable, the tint of the pigmentation acquired is unimportant. For these reasons, I maintain that pigment and pigmentation cannot be made measures for actinotherapeutic dosage for either local, superficial systemic affections.

VITAMIN D

The most striking and best known of the systemic photochemical effects are produced exclusively by the energy between 289 $\mu\mu$ and 313 $\mu\mu$. (Kramer, Hess and Weinstock.) If the spectrum from a therapeutic lamp is weak or wanting in these wave lengths, it may emit all the rest and be worthless for the production of vitamin D and its therapeutic effects. On the other hand, if any given radiation lies within this portion of the spectrum it is correspondingly valuable for the production of vitamin D and its therapeutic effects which have to do with calcium and phosphorous utilization, endocrine

activation, blood changes, growth, metabolism, etc.

What is the actinotherapeutic dose capable of preventing rickets, curing rickets and keeping it cured? Is the antirachitic dose the same as that for tuberculous bone and joint diseases, for osteomalacia, for tetany, etc.?

Stating the problem as the amount of activated ergosterol required for the above purposes, what is the minimum area of skin which contains that amount of ergosterol and how often shall that area be irradiated and what is the minimum quantity of radiant energy required daily in each case? Is *any* actinic radiation necessary to maintain health and vigor provided the diet contains vitamin D?

We are brought to the realization that the only standard for systemic actinotherapeutic dosage is the reaction of the patient under treatment to the form of energy used. Every case will present an individual factor. As treatment progresses, dosage will be continuously graded by symptoms, signs and reports from x-ray and biological laboratories.

To compare results properly, and so, in a measure, standardize technic, the following factors should be recorded in every actinotherapeutic treatment:

(1) A spectrogram backed up by a test with the Dorno cadmium cell when energy from the Dorno region is to be administered; not essential when pure metallic naked arcs are used. (2) The peak potential in volts and the peak current in amperes when in operating efficiency; (3) the standard distance between the source and the skin of the patient; (4) whether single or multiple arcs; (5) whether air cooled or water cooled if mercury arcs, and when quartz applicators are used, their length and whether on ultraviolet filter was employed; (6) the presence of a parabolic reflector; (7) the time of each exposure and the area of skin exposed; (8) the reaction of the skin and the systemic reaction. The last factor consists of signs, symptoms and laboratory reports.

As regards dosage in actinotherapy, much of the present obscurity is due to the carelessness of even the best writers in their nomenclature. None but exact, descriptive and unequivocal terms should be used.

Such terms as light therapy, ultraviolet therapy, Alpine light therapy, quartz light therapy, radiant light therapy, etc., are horrible examples of talking and saying nothing. Then, again, different technic with radiant energy having dissimilar spectra have been reported as though all were of the same species.

Can it be said that identical physiological reactions are to be obtained from arcs using tungsten, iron, cadmium, mercury, nickel, aluminum, copper or carbon electrodes? Do composition electrodes all produce the same effects? Are the effects of solar rays reflected from sky, snow, ice and water identical with effects from high ampered carbon arcs or from metallic arcs? How is it possible to have one standard for all these effects?

Based upon the false premises that the term ultraviolet denotes a fixed and invariable unit of photochemical energy no matter what its source or how mixed with photothermal energy, a number of methods for standardizing actinotherapeutic treatment have seriously been presented.

Other factors are calmly ignored, viz., that a physiological reaction is a purely individual one, depending upon the nature and function of the cell irradiated; whether the energy reaches the cell; what wave lengths are selectively absorbed; the substances created and their secondary effects locally and systemically. There is nothing in the appearance of any part of the spectrum which bespeaks its physiological effect.

There is nothing in the aggregate energy of any radiation expressed in gram calories per second per unit area of skin whereby to determine the physiological efficiency of that radiation. One could produce several spectra with the same aggregate energy possessing different physiological effects.

The chemical changes of certain substances when exposed in quartz capsules may be made into a scale by means of visible changes of color

tint, employing as an arbitrary standard any source of actinic energy. The same source may produce quite a variety of physiological reactions, varying in degree with technic and the individual, but one cannot be used as a measure of the other.

We are asked to believe by those who accept the dermatitis standard of dosage that by the adoption of an artificial scale based upon some arbitrarily convenient standard it is supposedly possible to come to some sort of an estimation of the physiological reaction to any mixture of radiant energy whatever, always called ultraviolet. And for what? Can the dosage for rickets, dermatitis, tuberculosis ,eczema, osteomalacia, mucous colitis, gastric ulcer, tetany, be based upon the changes in color or tint of lithopone paint, acetone methylene blue, chemical pastilles, photographic films, or paper impregnated with paraphenylendiamin nitrate or potassium ferrocyanid? How could it when most diverse spectra will give the same reading? The reading does not distinguish between spectra nor indicate what wave lengths are present and what absent.

Wave lengths of energy which are not present as shown by dark bands in the spectrum are like missing teeth from a set. They contribute nothing to the general effect. The Furstenau Actinometer has been suggested. It is based upon aggregate photoelectric effects. It is mentioned only because it is useless to the clinician.

Fortunately for the gentlemen who are practicing actinotherapy by the empiric instruction of the salesman who sold them their lamp, most lamps sold for the purpose of actinotherapy and called ultraviolet lamps emit some wave lengths in a most important area of the spectrum called abroad the Dorno region, which lies between 289 $\mu\mu$ and 313 $\mu\mu$ with the maximum effect at 297 $\mu\mu$. Any source of radiant energy which produces wave lengths within these limits is, according to present state of knowledge, valuable for actinotherapeutic purposes. If it contains as well, wave lengths down to 250 $\mu\mu$ it is especially valuable for producing dermatitis, and correspondingly contra-indicated for systemic effects. We are speaking of actinotherapeutic rays only. Your attention is invited to the accompanying diagrams and charts, showing the regions which produce certain well known reactions, and the spectra of sources of radiation used in actinotherapy. It will be noted that the Dorno region cuts across the area of greatest dermatitis effect, it includes what are called here antirachitic or vital rays.

The cadmium cell has been incorporated into an instrument to estimate total Dorno energy of any given irradiation. This instrument depends upon the electrical property of radiant energy to release electrons from metals upon which it falls. This charges the metal electropositively.

Cadmium is sensitive to radiant energy in the Dorno region selectively. A cadmium cell is therefore connected with an electroscope and both charged negatively. One limb of the electroscope is prolonged into a pointer, bearing upon a visible scale arbitrarily chosen. A known source of radiation containing the Dorno rays such as the mid-day sun on a particularly clear day is tested. The charged instrument, with the pointer beyond zero, is exposed for any given period to the solar rays by means of an automatic shutter.

The time rate necessary for the discharge of the electroscope as indicated by the time the pointer takes to travel from the zero point to any point selected, is noted. The instrument is again charged negatively and the cadmium cell exposed for the same length of time to the unknown ray. The relation in elapsed time of the two readings registers the ratio of intensity in the Dorno region between the solar rays and the rays from the source being tested. It may be read also in volt seconds.

When one lamp is being tested against another, the cadmium cell must in both instances be exposed at the same distance from the radiating source. There are presented herewith some comparisons of various sources of energy used in actinotherapy with reference to the Dorno region made by the chairman of the committee on Phototherapy and Apparatus for the American Electrotherapeutic Association.

COMPARISON OF DORNO-INTENSITY (289 μμ TO 313 μμ) FROM DIFFERENT RADIANT SOURCES USING DORNO CADMIUM CELL

Employing an Efka Heliol lamp (enclosed arc), pure carbon electrodes, potential 160 volts and current 10 amperes as a standard at a distance of 16 inches.

Source of Radiation	Intensity scale Units	Reached in minutes and seconds
SUN (between 1 and 2 P.M. July 25, 1928, N. Y. City) Direct rays	3	25 min.
*EFKA Lamp, 220 volt with quartz globe, arc voltage 160	3	8 min.
*EFKA Lamp, 110 volt, open burning, arc voltage 80	3	4 min.
*TWIN ARC Lamp, 20 amp., 110 volt, A carbons, each arc 40 volts	3	3 min.
*EFKA Lamp, 220 volt, open burning, arc voltage 160	3	87 sec,
MERCURY ARC LAMP, 110 volt new burner, Hanovia Chemical Co., arc voltage 78, Amperage 4	3	75 sec.
†TWIN ARC Lamp, 20 amp., 110 volt, "C carbons," National Carbon Co., each Arc 40 volts	3	45 sec.
CURAY Lamp, 4.5 amp., 7.5 volts filament, tungsten, superheated to 5,610° C. in soda-lime glass bulb	2	25 min.

*Electric arcs with pure carbon electrodes.

†Electric arcs with composition electrodes of metallic salts and carbons.

The following are the results of the investigations by F. Dannmeyer[6] into Dorno intensity of various actinotherapeutic lamps using a 220 volt mercury arc in quartz with reflector (Hanovia air cooled type) as a 100 per cent reference standard.

	Per Cent
1. Hanovia mercury arc in quartz, 220 volts taken as the standard	100.0
2. Peemoller, aluminum-carbon horizontal arc	72.4
3. Hanovia mercury vapor arc, 110 volts	44.3
4. Peemoller, aluminum-carbon vertical arc	43.5
5. Jupiter, ultracarbon (metalic composition) electrodes parallel	33.1
6. Iron-carbon arc	14.1
	33.2
7. Jupiter with "white flame" carbon electrodes	12.5
8. Old carbon arc lamp with pure carbon arc	9.2
9. Ultra Sonne	2.7
10. Siemen's Aureole with window glass globe	0.0
11. Sollux or Spectrosol incandescent filament in window glass	0.0

The Nernst glower gave insufficient "Dorno Rays" while the magnesium induction spark was not measured. Unfortunately potential and current were not stated, a most important omission.

As between two sources of radiant energy emitting rays in the Dorno region (having the same wattage), we would select the one with a continuous rather than a discontinuous spectrum for therapeutic reasons and the one with least initial cost and operating expense for economical reasons. Judged by these two standards the electric open arcs, operating at 80 volts and 10 amperes, using combination electrodes (the "C" and "K" of the National Carbon Co.) is preferable to the mercury arc quartz operating 78 volts and 2 amperes.

PHOTOTHERMY

Radiant energy between 500 μμ and 1.4 μ with the maximum at about 770 μμ, possesses the greatest photothermal effect and produces physiological reaction to heat by all tissues which absorb these wave lengths.

How far do these wave lengths penetrate?

The physicians on the one hand are quite positive with their diagrams and experiments with depths of water and the use of colored filters that caloric wave lengths do not penetrate in effective intensity much beyond an inch. Coblenz[7] concludes that energy between 659 μμ and 1.5 microns are the only wave lengths to reach the blood.

When the skin is unpigmented, these rays penetrate to a varying depth depending upon the transparency of the tissues to the wave lengths present in the ray. When the skin is pigmented it absorbs the greater part of the radiant energy in the entire phototherapeutic spectrum as heat.

As good absorbers are good radiators, the pigment radiates the heat freely as invisible infrared rays. It also loses heat by conduction to neighboring tissues and the blood and by convection to the air in evaporating perspiration

There is sufficient clinical evidence to prove that even if caloric energy does not of itself penetrate, it does produce highly valuable therapeutic effects in cellulitis, arthritis, sinusitis, mastoiditis and otitis media, and infections of lungs, abdominal organs and even of the spinal cord. Possibly secondary tertiary rays play a part.

DOSAGE IN PHOTOTHERMY

What is the basis of dosage in photothermy? It is a matter of intensity and reaction. How much water will quench a fire? Enough. Continue the irradiation until the physiological reaction produces the therapeutic object sought for.

In local treatments the source of the irradiation must be near enough to produce the maximum intensity which is just tolerable to the bare skin of the patient or the hand of the nurse placed at treatment distance. The irradiation must be continuous until convalesence is assured. This means possibly night and day for a number of days in some cases.

In systemic treatments the object sought may vary—elimination, increased metabolism, detoxification, disinfection, or mere heating—as such the treatment is given in a photothermy bath, for the time necessary as gauged by the patient's individual reaction.

SOURCE OF PHOTOTHERMAL RAYS

For systemic treatments a number of 25 to 40 watt incandescent electric lamps may be used in a bath cabinet or under a bed cradle covered by a sheet.

The physicist says that the tungsten filament lamp emits a preponderance of thermal rays in the region to which the body is most transparent.

The phototherapist says that he can obtain in the same period of time a greater physiological heat effect with the carbon filament lamps than with the tungsten.

The use of high wattage (500 or more) incandescent lamps with or without reflectors is inefficient therapeutically since they are too heating to be approached closely and so most of the energy is radiated into space and does not reach the patient.

Electric heaters and glowers and black body radiators while therapeutically effective in a pinch are too wasteful, converting most of their electrical energy into wave lengths greater than 1.4 microns which are not absorbed.

The solar and carbon arc rays after being filtered through common glass, are purely photothermal. To determine the heating efficiency from a physical standpoint, balometers and thermocouples are required. Experimentally, thermocouples may be inserted into cavities, sinuses, fistulae or wounds to determine the degree of heating at a particular depth.

The higher that the temperature of the radiator rises the farther does the maximum physiological heating effect shift to smaller and smaller wave lengths.[8]

The wattage of an incandescent electrical arc or filament lamp is an approximate figure, therefore, not only of its radiation intensity but also of the wave length in which its maximum energy is delivered. The absolute temperature multiplied by max. energy =K (a constant).Thus the carbon arc at a temperature maximum of 4200° C. also radiates its maximum energy at 700 $\mu\mu$ which is photothermal.

HELIOTHERAPY

Heliotherapy employs all the available energy of the solar rays. About 99 per cent is converted into heat when absorbed. The portion called the Dorno region is about one-millionth of the total solar energy. In addition to direct solar radiation, the rays diffused from the sky and the rays reflected from ice, snow, water and sand are highly important. They contain a preponderance of actinic rays especially in the Dorno region. Climate, altitude and latitude also enter into the problem as well as the relative amount of atmospheric impurities

in the form of dust, smoke and fog. For these reasons every location where heliotherapy is given must standardize its own dosage, and the character of the diseases under treatment will develop a distinct technic. It may be said with surety that there is no location accessible to solar rays where heliotherapy is not practicable.

The great factor in heliotherapy which distinguishes it from all other forms of phototherapy is the training of the skin to perform its natural functions unmodified by clothing and artificial heating.

This weathering of the skin is of the highest therapeutic value. It cannot be too urgently recommended to the civilized white man who can form a good tan. It would be better if outdoor games were participated in by parties strictly of one sex so that the wearing of breechclouts might afford a weathering to the skin. In winter, the individual so weathered finds that by exposure of the nude body to the radiant heat of the sun he feels warm though he may be chilly when he puts on his shirt. Winter sports are perfectly possible in a loin cloth, shoes and a cap. I consider weathering of equal importance with solar irradiation. Weathering must be attained gradually. It cannot be attained by the individual who cannot pigment.

For the same reason the non-pigmenting white man does not do well in the tropics, he cannot expose himself to solar energy without developing a dermatitis, and clothing, by preventing heat dissipation, favors heat stroke. A white man who can tan will get along as well in the tropics as a native.

Aside from weathering, very little exposure daily of very small areas of skin, the face for instance, is sufficient to obtain the benefits of the Dorno rays of the sun in any climate. It is only those who combine indoor life behind glass windows or in artificially illuminated places with a diet insufficient in vitamines and especially vitamin D who suffer.

For these reasons one does not need to inquire too meticulously into climatology and meteorology when considering the establishment of a station for treating with heliotherapy.

ARTIFICIAL HELIOTHERAPY

Artificial heliotherapy provides us with substitutes of invariable radiant strength and spectral quality. It can be employed both night and day, indoors or outdoors. Weathering should also be made a feature of artificial heliotherapy wherever possible.

The present sources of artificial heliotherapy are electric arcs employing pure carbon electrodes. They are of any wattage desired and may be open burning or closed hermetically in a chamber of quartz or a glass transparent to all rays as far as 250 $\mu\mu$,

In 1927, Dannmeyer reported the successful manufacture of an incandescent tungsten filament lamp in a globe of ultraviolet Kron glass which transmits wave lengths as small as 254 $\mu\mu$, also a lamp with a new glass flux, name and composition not mentioned, which also transmitted the "Dorno Rays." He tested it with the Dorno cadmium cell.

For a basis of camparison he determined the strength of this region in the sun's rays in Hamburg which were as follows:

In March the instrument read 25 volt-seconds (energy in the Dorno area).

In May, the instrument read 50-60 volt-seconds.

In July-August, the instrument read 100 volt-seconds.

Testing the incandescent lamps with the new glass globes for energy in the Dorno area gave:

With the 250 watt lamp at a distance of 1/2 meter (19 1/2 inches) 20-25 volt-seconds with the 500 watt lamp at a distance of 1/2 meter 40-50 volt-seconds; with the 1000 watt lamp at a distance of 1/2 meter 90-100 volt-seconds.

These lamps have not yet made their commercial appearance. The combination of carbon filament lamps with a mercury arc or other metallic arcs to add heat is a poor substitute arrangement for the pure carbon arc. It is a most convincing admission that the radiation

from the so-called ultraviolet lamps is not an equivalent therapeutic substitute for solar or carbon arc energy.

Pure carbon emits a spectrum more nearly resembling that from the sun than any other substance examined by the U. S. Bureau of Standards. (Locus cit, p. 548). The weaker arcs employing pure carbon electrodes do not cause the dermatitis that stronger arcs and the sun do, but are highly efficacious as actinotherapeutic sources.

The so-called therapeutic or impregnated carbons give so much energy in the actino region and so little in the thermal region, that their effects are violently actinic. It is analogous to adding the juice of ten lemons to a glass of good lemonade. In so far as general therapeutic efficiency combined with economy of operation are considered, the electric arcs hermetically enclosed in *special* glass or quartz and using *pure* carbon electrodes are preferable to all other sources for artificial heliotherapy.

For actinotherapy in dermatological conditions requiring the reaction of dermatitis the mercury vapor arcs, the metallic arcs and the reinforced carbon electrodes "H," "C" and "K" of the National Carbon Co. are preferable. (The latter must be used in open arcs.)

As regards the tungsten lamps with special transparent globes and higher wattage which Dannmeyer tested, we know that the tungsten filament of the ordinary lamp emits radiation throughout the entire region of the solar spectrum, but in radically different proportions. It emits radiation as far as 290 $\mu\mu$ but in very small quantities. According to Luckiesh, its energy distribution curve (graphic) has its maximum nearly in the region in which the human body is transparent that is to say in the photothermal portion of the spectrum. It is therefore a good source for photothermy especially the gas-filled bulb, whose caloric rays penetrate more readily. Increasing the wattage increases the temperature which shifts the maximum energy emission farther toward the small wave of the spectrum. This increases the enrgy in the Dorno region so that Dannmeyer's findings are believable. These lamps when introduced will prove rivals of all other sources for artificial heliotherapy. Owing to their high temperature the filaments last but a few hours so that it is not likely they will compete commercially with the present gas-filled Mazda.

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LIGHT THERAPY—ITS INDICATIONS AND METHOD OF APPLICATION IN OTOLARYNGOLOGY*

DR. MAURICE WEISBLUM

PHILADELPHIA, PENNSYLVANIA

A thorough knowledge of the physical properties and physiological effects produced by the various rays upon the living tissues is of the utmost importance for the proper employment of radiant energy in the treatment and amelioration of pathological conditions.

A brief description of the different rays will therefore be given, before proceeding with the discourse on their therapeutic value.

The following rays are employed as therapeutic agents at the present time: The solar, red, infra-red, blue, ultraviolet, x-ray and radium rays.

The solar rays, coming from the sun and constituting a combination of all enumerated above, with the exception of the x-ray and radium emanations, have both heat producing and actinic or chemical properties. The solar rays, as we all know, have been utilized from time immemorial, with beneficial results in the treatment of constitutional and local diseases.

But the sun does not shine every day and so we cannot obtain solar rays when it is cloudy or raining. Then, many of the ultraviolet rays, especially those of the very short wave lengths, are absorbed by the particles of dust in the atmosphere. It is for this reason that the sun's rays are more beneficial at high altitudes and at the seashore. At the latter place the individual also receives the benefit of the rays reflected from the sand and thus receives a double dose.

Ordinary glass absorbs the ultraviolet rays the wave length of which is less than 3,200 angstrom units, which explains why people do not tan sitting in glass-enclosed rooms, as it is the ultraviolet rays of the shorter wave lengths which produce the chemical changes in the tissues. There is now, however, manufactured a special glass which does transmit rays whose wave length is less than 3,200 angstrom units, thus overcoming that difficulty. Wave length is the distance between two crests or two troughs of the wave, or vibration in the ether, and is the speed of light divided by the number of vibrations per second. An angstrom unit is one-ten millionth of a millimeter.

The infra-red is a ray the value of which as a therapeutic agent has only been recognized in recent years, and which requires much study and research. This ray occurs at the near end of the spectrum and has a wave length of more than 7,700 angstrom units. It is an invisible ray, because the vibrations are too slow to form an impression upon the retina.

The infra-red ray is produced by glowing carbon arcs, an alloy of carbon and iron, and other metal electrodes. And also by very hot black bodies. The lamp which predominates today is one containing composition metal electrodes, and consuming as much as 1,500 watt hours. One-hour exposures will accomplish the desired result. When weaker lamps are used the duration of treatment must necessarily be increased.

This ray penetrates the tissues to a depth of about 7 inches, and when absorbed, heat is generated.

The strength of the rays is directly proportional to the heat and size of the electrodes and inversely as the square of the distance.

These rays, due to their deep penetrability and heat production, induce a deep hyperemia, an increased circulation in the part exposed, and a consequent absorption of the inflammatory exudate. Since there is a considerable rise in temperature, it is believed that many of the bacteria are thus destroyed. The rays also have

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a sedative effect upon the nerves. These rays are utilized chiefly on account of their heat production in the deep tissues, and are therefore of benefit in the early stages of mastoid disease; but are contra-indicated when pus is present.

In trifacial neuralgia they exert a soothing influence and at times relieve the pain completely.

The infra-red rays help to relieve the congestion in otitis media, and also to ameliorate the pain.

They will hasten suppuration in furuncles of the ear and nose, and may also abort them if applied at the onset.

We have been enabled to facilitate the drainage of the sinuses with the aid of infra-red radiations.

The exposures to the infra-red rays should last at least one hour daily at a distance of about three feet. In severe cases, two treatments daily may be necessary.

The ultraviolet rays are derived from heated carbon electrodes or from the mercury quartz lamp perfected by Cooper-Hewitt, and later by Kromayer.

About thirty years ago Finsen perfected a carbon lamp which generated rays equivalent to the solar but rich in ultraviolet rays of short wave lengths, less than 3,200 angstrom units.

Later, Cooper-Hewitt demonstrated that a current passing through vaporized mercury enclosed in quartz generated almost pure ultraviolet rays, some of which are as low as 2,000 angstrom units.

This is an air-cooled lamp.

Kromayer perfected a water-cooled mercury quartz lamp which enables one to employ quartz attachments, by which cavities can be exposed to the rays. These rays are of short wave length, and are invisible because their vibrations are too rapid to produce an impression on the retina.

The ultraviolet rays are actinic or chemical in character and produce chemical changes in all matter upon which they impinge. They penetrate to a depth of about one-thirty-second of an inch and when the tissues are compressed the penetration is two or three times as great. They produce tanning of the skin by the deposit of pigment from the blood in the capillaries. Some observers believe that this radiant energy is absorbed by the blood and that the endocrine glands are stimulated thereby, that the calcium and phosphorus content of the blood is raised and that there will be an increase in the number of leukocytes.

It is important to know that individuals react differently to exposure to the ultraviolet rays, that blondes will react more strongly than the brunettes, and that individuals become more sensitive to the rays after ingesting certain chemicals, such as eosin ,reorcin and cholesterol. When treating superficial lesions it is advisable to remove all scabs and crusts, otherwise the rays will not reach the diseased parts.

The ultraviolet rays destroy the tubercle bacilli very rapidly, so that they are an important adjunct in the treatment of tuberculous ulcers of the tongue, pharynx and larynx. With suitable quartz applicators the rays can be directed to the lesions.

In chronic rhinitis the rays exert a stimulating influence upon the mucosa and promote a restoration of normal function. The writer has obtained favorable results in patients with sinus disease, relieving the headache and sense of fullness. It is difficult to explain the modus operandi in these cases, as well as those with bronchial asthma, yet some of the patients are relieved just the same.

It is my belief that the large quantity of ozone generated while the lamp is burning exerts a beneficial influence.

In wounds resulting from mastoid operations where the healing had been protracted, we were able to stimulate the tissues and to hasten the closing of the wound.

Eczema of the ear, both dry and moist, responds favorably to ultraviolet radiation.

Two cases came under our observation recently, one of which was of nine years duration, and, after an intensive course of treatment the itching and desquamation disappeared.

In treating external lesions it is advisable to give four-minute exposures at a distance of thirty inches at intervals of three or four days, depending upon the amount of erythema produced.

We have obtained more favorable results by longer and more frequent exposures in children as well as in adults, than by one-half or one minute radiations.

In fact, it has been our experience that a one minute exposure at thirty inches is practically valueless.

Mucous membrane and cavities may be exposed for twice the length of time and at more frequent intervals.

As the treatments continue the time of exposure is increased and the distance is decreased.

The eyes of the operator, nurse and patient should be protected with colored glasses to prevent conjunctivitis.

I hve seen severe cases of conjunctivitis in operators who were careless, but these cleared up promptly when proper care was observed.

There is only one instance in the field of otolaryngology where the ultraviolet rays must not be used, and that is when malignancy is present. These neoplasms are stimulated and grow very rapidly after exposure to the rays.

The blue and red rays are only useful because of their heat production but have no power of penetrating tissue.

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CONCLUSIONS

1. Physicians should possess a thorough knowledge of the physics and physiological action of radiant energy in order to properly apply this modality.

2. Light therapy is a useful adjunct in the treatment of the disease, but is not a panacea for all ills.

3. Light therapy is of material aid to the otolaryngologist if applied intelligently and when indicated.

4. Hay fever was not benefitted by ultraviolet.

DISCUSSION

DR. A. F. TYLER (Omaha, Nebr.): There is one statement that Dr. Weisblum made in his paper that should be criticized. He said that he started his treatments, general body radiations with the ultraviolet, at a distance of thirty inches for four minutes. That may be perfectly true with the lamp which he is using, but I should like to sound a note of warning that with new lamps that would be an exceedingly dangerous dose to start with. In many instances at least there would result a very pronounced erythema, and in most cases of children I am sure we would get vesication. So, I think we should be pretty careful in setting down definite doses with which to start our ultraviolet radiations. We had better work up gradually to the patient's tolerance. This is necessary because of the fact that no two lamps give out exactly the same amount of energy.

To advocate fixed dosages for general use would get a lot of us into very serious trouble. The moment you produce a pronounced erythema or vesication with general body ultraviolet radiation you defeat the very purpose for which you are giving the treatment. You would have to stop and wait then until the skin cleared up. Furthermore, in some patients in whom pronounced skin reactions are produced you would get an intense proteid intoxication from the breaking down of all the skin cells. Some very disastrous reports have been published in the literature from overdosage of ultraviolet.

DR. L. LEO DOANE (Butler, Pa.): In regard to the ultraviolet, I have treated mastoid cases, but with the lamps that I have I know it would be very dangerous to start out in a new case with one of the treatments. I never give more than one minute.

In regard to the infra-red, I use that a great deal in mastoid cases, and I have a great deal of confidence in it. Of course, where there is a drum membrane and general inflammation in there, the thing to do is operate and clean it out, perhaps use a little suction, and then use infra-red.

I, personally, have become accustomed to a very long usage at one time and possibly that would be

better, but I have had some good results in using the infra-red from twenty minutes to half an hour, pretty close and pretty hot, once or in some cases twice a day, and I haven't felt called upon to use it for any greater length of time.

I have, as I said before, a great deal of confidence in the results. There are few mastoid operations today except in old chronic cases which can't be cured in any other way than by operation. I have had excellent results with ionization; I might say that I used it before I ever heard of its being done by anyone else. That was at least seven years ago, perhaps a little longer. At that time I had never heard of its being done. I knew in a general way the general principle, of course, that it was applied in the case of tumors, but I hadn't heard of its being done in suppuration of an ear. It seemed to me it might be a good idea to try it, and I did with excellent results in my first case. Of course, I found subsequently that others had preceded me in this kind of work, but I have used it in quite a good many cases since and usually have been successful in eliminating suppuration. Of course, it is impossible to do that in all cases because all patients cannot stand it, but results have been good.

I might just refer to one case of hay fever in which I used a one per cent solution of copper sulphite. The case was in perhaps what you might call the terminal stages of hay fever, but the patient responded very nicely and felt very much improved with that one treatment.

Dr. Maurice Weisblum (Philadelphia): In answer to Dr. Tyler, I wish to say that we use an Hanovia lamp. When we have used a new lamp we have gotten erythema. The first sign of an overdose in a child would be for the child to become very restless, fretful and fidgety, and we have never found this to happen. We measure the distance and we have never had a vesiculation or a blister. We get a marked erythema, it is true, and perhaps instead of waiting two days we will wait three days to give the next treatment.

1823 Pine Street.

ELECTROTHERMIC METHODS IN DENTISTRY*

C. E. NORRIS, D. D. S.
INDIANAPOLIS, INDIANA

If we are to achieve success in the application of high frequency currents in the oral cavity we must first have a basic knowledge of its principles and a thorough understanding of the technic of application.

There are two different methods by which we may apply high frequncy currents: (1) medical diathermy which gives us a constructive thermal effect, i.e., one which does not go above the physiological limits of the tissues; (2) surgical diathermy which gives us a destructive thermal effect destroying tissue.

Grover says: Surgical diathermy differs from medical diathermy simply in the density of the current applied. In constructive thermal effects the object to be obtained is to raise the temperature of the tissues without destructive effect, while in destructive thermal effects the object is the destruction of the tissues by heat.

Much has been said and done by the medical profession in the treatment of superficial malignancies, tumors, warts, nevi, moles, etc., by electrothermic methods but comparatively little has been said or done from a dental standpoint.

In the treatment of pyorrhea alveolaris, tumors, cysts, pyogenic membranes, abscesses, etc., in the oral cavity it offers several advantages over the well known surgical, medicinal and mechanical methods now employed.

Advantages:

1. It is practically never necessary to do more than one operation.

2. Most of the operations may be done under local anesthetic.

3. The instrument sterilizes as it cuts, thus tending to make the wound aseptic.

Hemostasis—No time is lost in the ligature of vessels as the current seals blood and lymph vessels.

4. Postoperative pain is practically nil due to obtunding of the sensory nerves.

5. Healing is very rapid and scar tissue relatively small with this method.

Disadvantages:

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1. Economics—This equipment is very expensive for the average dentist doing general practice.

2. High frequency currents are extremely dangerous in the hands of an inexperienced operator, e. g., if deep pyorrhea pockets are injected with local anesthetic and the current applied too strong there is danger of destroying the underlying bone, which would necessitate the extraction of the teeth and the complete curettement of the area.

Thermal Effects—Constructive.

Lurie has probably done more with constructive thermal effects in the oral cavity than any other man. He has devised an electrode whereby it is possible to heat the tissues of the mouth to around 112° F. without any discomfort to the patient and with very good results. This is applied by using an indifferent electrode on the back of the neck, care being used as to its adaptation and the active electrode placed in the mouth in contact with tin foil which is previously adapted to the tissues, assuring a perfect contact. This supplies heat in the tissues which does not go above their physiological limits.

Thermal Effects—Destructive.

There are two well known methods of applying destructive thermal effects in the oral cavity.

1. Desiccation: Devised and developed by Clark is best used with a uniterminal oudin current, a high voltage and little amperage. Clark states the desiccation spark is not hot enough to carbonize but is of sufficient heat to cause rapid dehydration of the tissues, rupturing the cell capsule and converting the area heated into a dry mass. Using this method in the oral cavity, a common sewing machine needle is attached to a holder which is in turn attached to the oudin coil. This needle is held in pyorrhea pockets or small fistula tracts until the tissue is seen to turn white. The current is then turned off. This requires from one to fifteen seconds, depending on the strength of the current and the density of the area. This method is ideal in the treatment of pyorrhea pockets due to its simplicity and the shortness of time required.

2. Electrocoagulation: This differs from desiccation in that two electrodes are used and greater current applied. One electrode which we will term the indifferent electrode should be placed somewhere on the patient's body, preferably on the neck or back, care being exercised that it is well adapted to avoid burning. The active electrode is used in the field of operation. This method is ideal in the treatment and excision of large growths within the oral cavity and for large areas of infection and osteomyelitis of the mandible and maxillary bones. The active electrode in this procedure may be a needle, currette, cone, or blunt instrument.

CASE REPORTS

Mrs. J. H., age 68. Referred suffering with a large cystic tumor in the region of the left antrum. This patient had had three unsuccessful attempts made to cure the condition by lancing and drainage, but always with a subsequent recurrence. Patient sent to me after the third attempt had proved a failure. Probable etiology—patient had formed habit of sucking on plate, forming a vacuum which resulted in an irritation. X-ray showed a large area of destruction extending well into the antrum. Probable malignancy. Biopsy proved it to be a chronic osteomyelitis. Patient was given a gas-oxygen anesthetic and using a curette attached to the high frequency machine the area was completely electrocoagulated. Antrum was found to be full of pus. After operation wound was packed with iodoform gauze, dressings were changed daily and area thoroughly irrigated and cleansed. Water cooled quartz light was used to promote healing. Wound was completely healed in 45 days and patient is now wearing artificial dentures with no sign of recurrence. A gold bar was inserted in the palate of the plate to discourage further sucking.

Mr. I. W. S., age 35. Presented suffering with a very virulent infection of the region of the lower central incisors. Microscopic examination showed the presence of staphylococcus and streptococcus in great numbers. Treatment was introduced with water cooled quartz light

and after five treatments pain and swelling had subsided but pus still exuded around the necks of the teeth upon the slightest pressure. It was necessary to use electrothermy in this case to secure the desired result. A small sewing machine needle attached to the oudin coil was used in this case and the area desiccated under local anesthesia. Area was completely healed in two weeks. Over two years have now elapsed and there is no sign of recurrence. Quartz light was a failure in this case due to the inability of the rays to penetrate to the bottom of the pockets.

Mr. O. H. K., age 60. Referred with pyorrhea alveolaris. Pus exuding around the necks of all of the teeth and lower centrals and laterals loose. This operation was done without anesthesia, using a small sewing machine needle attached to the oudin coil and desiccating the areas. Sloughing of the areas occurred within a week and the areas were completely healed and teeth firm within a month. This operation was performed nearly three years ago and the patient has had no sign of recurrence. I have scaled and polished the teeth periodically since that time and gums are healthy and normal.

CONCLUSIONS

Electrothermic methods either constructive or destructive are of value in certain selective cases of neoplasm or chronic infective lesions of the oral cavity.

2. Although almost any high frequency machine might be utilized, it is highly advisable that a well balanced modern apparatus be obtained.

3. It is far more important that the operator acquire considerable skill in its use before applying it for destructive purposes within the oral cavity.

4. It is far better to use too little current than too much in the average case.

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409 Medical Arts Bldg.

PHYSICAL THERAPY IN GLAUCOMA*

CARL B. SPUTH, M. D.
INDIANAPOLIS, INDIANA

Glaucoma is one of the most trying eye diseases for the oculist to treat. In the first place, many of the patients fall into our hands after the disease is in its advanced stages; and secondly, it is difficult to get the whole hearted co-operation of the patient. Most people fear operations on the eye; in fact, it has been my experience that the majority of the glaucoma victims absolutely refused surgical interference until vision is practically lost or the pain has become unbearable. For the above reasons, I resorted to every palliative measure at my command, and finally applied physical methods as a means to cure or at least to check the progress of the disease.

Surgery for glaucoma in my practice has been limited to paracentesis, iridectomy and trephinning. The best surgical successes were achieved by a modified Elliott trephinning. Results were far from perfect. The most frequent failure was due to the formation of adhesions interfering with the drainage.

The general symptoms noted in glaucoma are as follows:

Objective:

1. Rise in intra-ocular tension.
2. Change in the size and shape of the pupil.
3. Pupil dilated.
4. Cornea cloudy.
5. Shallow anterior chamber.
6. Aqueous and vitreous turbid.
7. General hyperemia of conjunctiva and episcleral blood vessels . Sometimes edema.

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8. Cupping (excavation) of optic disc (nerve).

9. Pulsation of blood vessels on optic disc.

Subjective:

1. Pain (neuralgia of the trigeminal nerve.)
2. Alteration in sensibility of cornea.
3. Failing of central vision.
4. Changes in refractive power of the eye.
5. Diminution of the amplitude of accommodation.
6. Contraction of peripheral vision.
7. Iridescent vision.

Blurring is an important symptom too often overlooked. Blurring complained of in the vast majority of cases may be due to uncorrected astigmatism, convergence insufficiency, or acommodation overload.

The anterior segment of the eye should be examined very carefully, first by daylight, and then by oblique illumination and loupe. Dilation of the anterior ciliary veins is found in advanced cases of the inflammatory type of glaucoma, yet this picture is often markedly present in the non-inflammatory form. The steamy cornea is ordinarily accompanied by deep circumcorneal injection. In the mild type, with no congestive signs or dulling of the corneal surface, the slight haze is only brought to view by oblique illumination.

With the ophthalmoscope, one must carefully examine the blood vessels. The veins are distended and tortuous throughout, indicating congestion.

The nervehead shows a shallow cupping at first, due to its recession under intra-ocular pressure. If the intra-ocular pressure persists or increases, the cupping becomes deeper and the optic disc begins to shrink with gradual atrophy of the optic nerve. At this stage of the disease, it is too late to ask for help. If the nerve fibers are still pink, I feel that much can be done by proper medical and surgical relief to arrest and avert optic atrophy which means loss of vision. The estimation of glaucomatous damage can best be made, not by the cupping, but by the color of the optic disc and by the size of the blood vessels.

I am sure that a great many cases of glaucoma could be found if we as oculists would make a more careful examination of the eyes on patients who come to us for refraction. True, scores of people who need glasses go to incompetent so-called eye-sight specialists who make free eye examinations and sell glasses. One of the earliest symptoms of glaucoma is a contraction of peripheral vision, especially the nasal side, therefore the visual field should be taken in every case that is to be refrected. Suspicious cases should be kept under observation and proper treatment instituted early.

My treatment of glaucoma by physical therapy dates back to 1923, when I treated several cases with good results. In spite of my success, I dropped the physical measures and resorted to surgery for a number of years. Of late years, I am again using as principal treatment for early glaucoma, physical therapy combined, of course, with the regular routine treatment which has been in practice for years. In advanced cases, I recommend surgery followed by physical therapy. Whenever the intra-ocular pressure exceeds 50 with the McLean tonometer, surgery is recommended. I have treated cases with negative galvanism, diathermy, and infra-red, but find that my results are far better with the high frequency using the tesla current.

After diagnosis of glaucoma is established, every effort is made to find the primary cause for the disease and this is treated accordingly. The local treatment consists of pilocarpin ½ to 1% or eserin ¼ to ½% which the patient instills into the eye one to three times daily at home. The routine office treatment is as follows:

1. Inspect the eye.
2. Take ocular tension with McLean tonometer before and after treatment.
3. Use tesla current with vacuum eye electrode, beginning with ten minutes and increasing to twenty.
4. Give treatments daily at first, then three times a week, etc.

The following are chosen from a great many cases and will illustrate the efficiency of the treatment.

Case No. 1. Mrs. A. L., white, age 57, referred by Dr. Jones, Jan. 10, 1923. Family history is negative. Personal history is negative excepting a luetic infection which Dr. Jones is treating. Complained of blurred vision and an uncomfortable feeling in the eyes. Ophthalmoscopic examination revealed a cupping of optic discs. Intra-ocular pressure with the McLean tonometer was 70 in the right eye and 60 in the left eye. An iridectomy was suggested which was refused. She was placed on eserin to be dropped in the eyes morning and night, and was given daily treatments in the office with the high frequency current. On March 1, the tension dropped to 50 in each eye. By June 1, the tension was down to 40. After this, she received two treatments a week. On Sept. 23, the tension was 30 in each eye. Treatments were continued until Oct. 23, 1923 and the tension remained constantly at 30. She was refracted on this date and with a plus .50 over each eye, she was able to read 20/30. A plus 3.0 was added for near work. The patient was last seen on January 14, 1928. Her condition was unchanged and she has had no eye symptoms for over four years.

Case No. 2. Mr. J. B., colored, age 65, a patient of the City Dispensary Clinic. He has lues and is under treatment for same. No other personal history of importance. In 1922 he had a cataract removed from the left eye and one year later from the right eye. He returned to the clinic september 12, 1924 with failing vision, cloudy cornea, pain, and an injection of conjunctivae. Intra-ocular pressure was 90 in each eye. Diagnosis—glaucoma. He was referred to the hospital for an operation. An Elliott trephine (at 12 o'clock) was made in each eye by a very good surgeon. He had relief for several weeks but returned to the clinic on account of pain and the inability to see. Adhesions had formed over the trephine. These were broken up only to form again. Six months later, during my hospital service, another trephine operation was performed opposite to the first trephine (at about 6 o'clock). He ran a similar course; in other words, our operations did not give him relief. He was put on eserin, pilocarpin, dionin, subconjunctival injections, etc., all to no avail. At a loss what to do next, he was given daily treatments with the high frequency (tesla) and eserin for home use. This afforded him the most relief. His intra-ocular tension which heretofore ranged from 80 to 90 dropped to 50 after one month's treatment. Vision—shadows only.

Case No. 3. Mrs. M. J., age 78, colored, referred by Dr. Furniss, on November 10, 1927 for eye examination. Mrs. J. complained of excruciating pain in the left eye, radiating over the top and left side of the head. Conjunctiva congested, cornea cloudy and vitreous hazy were the symptoms noted. No ophthalmoscopic examination could be made. Ocular tension in the left eye was 90 and in the right 40. Diagnosis—iritis and glaucoma. She was put on a home treatment consisting of dionin and eserin. Codien was given to allay the pain and give the patient rest. On November 18, she was placed on daily treatments with infra-red. On November 23, high frequency treatments were begun. After the first treatment, she said her eyes felt much better than with previous treatments and therefore, the high frequency treatments were continued. By December 13, the tension had dropped to 50 in the left eye and 30 in the right and her eyes felt very comfortable. For home treatment she was now given a solution of eserin ½% to de dropped into the eyes at bed-time. She made steady progress. On March 13 the tension in the left eye was 40 and in the right 30. From then on she came irregularly to the office. She was last examined June 29, 1928. The tension was the same as that of March 13. The cornea had cleared considerably, but the vitreous was still cloudy, and the lens cataractous. She reports occasionally and says she's "feeling fine."

Case N o.4. Mrs. W. E. H., age 68, white, referred by Dr. Van Osdol. Patient has been under physicians' care for gastro-intestinal disturbances and high blood pressure. She came to me on June 20, 1928, with all the symptoms of glaucoma in the right eye. She was extremely nervous, and was more worried by thoughts of failing vision than by pain. She was placed on pilocarpin for home use and instructed to return daily to the office for treatments. How-

ever, she failed to appear. I left on my vacation and did not see her again until August 8. She accused me of ruining her eyes with the medicine I prescribed. After questioning her, I found that she had not followed my instructions, but that she had used eye drops prescribed by a member of her family who is a physician, which I later learned was a solution of atropin 1%, to be dropped into the eye morning and night. The eye was considerably worse as well as were all her symptoms. The tension rose to 90 and the pupil was widely dilated. A treatment was outlined for her and she was to return the next day, but she failed to appear. I found out later that she had consulted another oculist, who verified my diagnosis, and suggested an operation. She returned August 10 and begged me to take her case. For home treatment eserin ¼% was prescribed to be used twice a day and high frequency treatments were given daily for two weeks. On August 18, the tension had dropped to 55, all the pain was gone and the eye was much improved in every respect. On August 24, the tension was 50. Treatments three times a week were now given and eserin cut to one drop daily. A lens was prescribed for her left eye which gives her perfect vision. She is much improved in every respect. On September 22, the tension had dropped down to 40, and both the cornea and vitreous are quite clear.

CONCLUSIONS

In conjunction with proper medical and surgical treatment for glaucoma, tesla high frequency applications with the vacuum eye electrodes aids distinctly in:

1. Relieving pain.
2. Lowering the intra-ocular tension.
3. Relieving the congestions.
4. Clearing the cornea, aqueous and vitreous.

DISCUSSION

Dr. L. Leo Doane (Butler, Pa.): I have had a few cases of glaucoma that I have treated by physical therapy. Some few years ago a man at the age of 65 years suffered an injury following which he became blind. He was very anxious to save the eye.

I began by using the vacuum electrode, alternating with negative galvanism. After each treatment I gave him a massage. There was a little improvement in the pain symptoms after the first treatment. I might say that this eye had been condemned by two oculists. The general surgeon who was doing considerable in the way of operating on the eyes advised removal, but the man would not consent to it.

I continued with this same treatment and he gradually improved. Finally the pain disappeared entirely and he retained his eye until the time of his death.

When I came to this convention I left a case of glaucoma under treatment. I started out, of course, using the usual medicine, combination of eserin and pilocarpin, about two grains of each to the ounce. The symptoms were very little ameliorated by that, and I began first with diathermy. The woman was in bad condition generally, emaciated, weak and nervous, and anything in the way of suggestion of operation would have upset her completely.

I began with diathermy, but I only gave her one treatment of that. There was a little relief, but I found she was going to take so much treatment if it were successful at all that it would be inconvenient for me to get to the house with even a portable machine. I therefore decided to try out the infra-red. I gave the first two treatments myself and then instructed the nurse to carry it out twice daily. The tension was 72 in the right eye; the left was practically normal. Although there has been considerable pain in spite of the treatment, the treatment has helped. She tried cold applications to start with and that seemed to make conditions worse. I used the heat day after day in the manner described and the pain has gradually receded. The tension is gradually going down. I left the woman feeling quite comfortable.

I have found this with infra-red: After its use for a considerable number of times it doesn't seem to have the same effect; in fact, sometimes the patient has told me she thought it made her eye worse, but if she would wait for a day or two after that and then resume heat, it would help her at once and has continued to do so.

Dr. Lawrence Glen Dunlap (Anaconda, Mont.): I should like to ask Dr. Sputh what physical measures he would recommend for a secondary glaucoma following a dislocated lens.

Dr. Carl B. Sputh (Indianapolis, Ind.): I am sorry I can't answer your question. I have never had any experience with secondary glaucoma treatment with physical therapy induced by a dislocated lens. I don't know what action it would have.

I meant to add in my paper that we do not hold the electrode snugly to the closed eyelid but get a sort of vibratory massaging effect at the same time. We find the results are far better that way than by simply holding it tightly gainst the eyeball.

I hope that I made it clear in my paper that the glaucoma treatment by physical therapy doesn't take

the place of surgery or other routine treatments. I think if we get the early cases of glaucoma we get better and more permanent results by iridectomy and good trephining. In cases where the vision is disturbed and there is a question of enucleating the eyeball, we do get splendid results by physical therapy. If we can save the eyeball it is far better than wearing an artificial eye, and the patient is much better satisfied.

BODILY MECHANICS*

F. H. EWERHARDT, M. D.
ST. LOUIS, MO.

I am going to try to present a method of teaching correct bodily mechanics, that is through posture, a simple method which can be of use in the office. It is applicable for a boy or girl 10 years old, or for a man or woman 40 years old. I shall follow the same procedure that I generally do when talking to our students or to our postgraduates.

The first point I wish to make is that I do not believe that faulty posture is the result of poor muscles. It has been my privilege and my great pleasure to have examined hundreds of college men and women, and I can remember seeing many who were almost as strong as athletes were supposed to have been and yet had poor posture. It is not the poor muscles which cause the bad posture, according to my notion.

The etiology of posture in its earlier inception has a hereditary background. Then there are congenital reasons why we have bad posture. For the most part most of us have bad posture because we have acquired bad habits. What I aim to do is to teach a short method by which this operation may be reversed from a bad postural habit to a good postural habit without the use of a great deal of exercise.

The first thing that I do when a woman brings her little boy or girl to me in the office is to appreciate the fact that the parent knows nothing about it and that it is equally important to teach the mother as the child. Therefore, I take shadowgraphs and use them because they help me a great deal. I take three shadowgraphs of the patient. Let us say we have a little boy 10 years old, or a girl, because there are more girls than boys who come to us. I take a shadowgraph showing the position the child naturally takes. I take a second shadowgraph with the idea of showing that picture the next day to the mother. The mother is instructed to tell the child to stand straight. She will proceed to use the commands with which everyone is familiar and which I will refer to later. Of course, she tells me that she has told her child a thousand times to stand up straight. Why doesn't she stand up straight? Because she does not know how, and the mother does not know how to tell her.

In the third shadowgraph I aim to represent the child as it can stand, the correct posture.

I have these three pictures before me the next day, and when the mother and the child come back, I analyze the pictures with the aid of a blackboard talk.

Remember, the theory is that it is necessary for the child to know how to stand straight. Therefore, it is also necessary for the child to know what is wrong with it. I proceed in this manner: Suppose that we draw three lines representing three pieces of wood, one on top of

*Read at the seventh annual meeting American College of Physical Therapy, Chicago, Oct 12, 1928.

the other, supposed to stand upright. We take a piece of wood six inches in diameter and cut it in three sections, one representing the distance from the floor to the hips, another from the hips to the shoulder, and the other from the shoulder to the top of the head. If we were to take these three pieces of wood and set them on the floor, would these three segments of wood stand upright if placed on the floor Ask yourself that question. Will they? They are six inches in diameter, representing the height of my body. The supposition is that the child will say they will stand one over the other. Why will they not fall over? Because the center of stress is all down. This is good posture.

Suppose we were to slant the lower segment one way and the second one another way and the third one another way. Will they stand one over the other? The answer is obvious, they will collapse because there are lateral strains and there is nothing to cause it to hold an upright position.

In the vast majority of faulty posture cases we find that the knees and hips are forward of a line which we will call the center of gravity, and which starts at the external malleolus. With the center of gravity line here, a good deal of the body lies forward. I draw these lines on the posture charts of the particular child to be treated.

I take more time with that mother and child than I am taking here, but I aim to bring a word or mental picture to the child to show it what is wrong. I say: If this is wrong, what are we going to do with it? Naturally the child says: We will bring this forward part back.

We use four commands. I start with the second, go to the third and fourth and come to No. 1. If these three segments are to be prevented from collapsing, joint No. 2 must be pushed back. What is the common expression which is used by teachers or fathers or mothers so far as the abdominal part of the body is concerned in referring to posture? Stomach in! But that does not do it. Drawing in the stomach does not move the joint back at all. The command is: Hips back!

Now, regarding the chest. You see where it is, behind the line of the center of gravity. The common command is: Throw your shoulders back, or throw your chest out. I have a hundred photographs which will illustrate my point. The child throws the chest out and this is what happens. And that is the picture I show to the mother. You don't get the effect if you say, Throw your shoulders back! or, Throw the chest out! We say: Chest up!

The fourth point is the culmination of a definition of good posture. Make yourself as tall as you can. If one does that, you acquire good posture. Good posture is a condition where the segments are placed one over the other in such a way that the organs work satisfactorily and there is no stress and no strain and the body is as tall as it can be. That is a simple definition of good posture. There are many, of course. We say: Head up!

Now we come to No. 1, which is very important, because it leads to the question of what is the cause of this zigzag posture. Too much weight on the heels causes the hips to go forward. Because the hips are forward, the chest sags in and gives this shoulder forward position, and then the head flops over and with it comes that forlorn expression which, in itself, is an interesting lecture.

If it is true that there is too much weight on the heels, the command naturally would be to place the weight forward on the forepart of the foot. The command then is: Weight forward!

Those are the four commands which we use.

After having established that, I ask the child to take his position, and I correct it: Hips back, chest up, collar button up, touch the ceiling with the top of your head. If the person brings the head forward, the hips back, the chest up and the head up, then she can raise her heels without the shoulder going forward; it is straight up and down. That is what I call the test. That is the basis of our method of teaching. If the

child will do this a given number of times during the day, we will get results.

From here we go to the one exercise which I give. It is given not for the purpose of developing or strengthening a muscle; it is not a developmental exercise. The idea of the exercise is two-fold: First, to stretch short muscles and ligaments; second, to arouse certain kinetic impulses.

We have assumed for many years a certain posture. When I stand in my own posture, I am comfortable for the time being, until I get fatigued.

If I take an exercise, and I have a bad posture, I will stretch ligaments and tendons and muscles that are shortened, and the object of this exercise is to stretch those ligaments and tendons, next to awakening certain impulses which are generated in the tendons, ligaments, muscles, and articular surfaces of our skeleton, a sort of sixth sense, sometimes referred to as the kinetic sense.

Suppose one were to close his eyes and raise his hand above his head. How does he know that his hand is up there? By a muscle sense. What is that muscle sense? By raising his arm up there, he has awakened secondary impulses in the joints, in the muscles, in the tendons of the part of the body concerned in this movement. He has done that, of course, for thirty, forty or fifty years, and has had in his consciousness a picture. When those impressions come to his consciousness, he has a picture, and that picture is that his hand is over his head.

When one takes this exercise, he awakens these very same impulses, which indicates that he has changed his posture. If it is true that he had bad posture to start with and by taking this exercise developed these various sensations or impulses, which denote a changed posture, then all he wants to do is to do that so often that he will not have any more sensations when he does the exercise. Then he will have the new position.

If one would take this exercise ten times in the morning and ten times in the evening, and perhaps a few times during the day, and did that from ten to thirty days, it would be found later that one could take the exercise and get no sensation of pain. Then if he would test himself he would find that he had the correct posture.

We believe that the child will understand if she knows something about the mechanics and knows how to stand straight. The third thing is to get her to continue to stand straight. The old idea was to give a great deal of exercise. I don't believe it is necessary. I have figures of men 40 and 50 years of age who came to my office because they were helpless and could not carry on their work. They had nothing organically wrong, but when they came to me and I took their shadowgraphs and showed them to them they could scarcely believe they stood like that. I took another shadowgraph representing the correct posture.

How can we get the child to continue to stand in this corrected position? This is our method: The child is told to take this exercise ten times in the morning, perhaps at noon, and ten times in the evening, perhaps twenty times, or as much as can be done.

I ask the child if she is willing to co-operate with me and tell her if she isn't that we can do nothing for her.

I have in my office some scoliosis jackets which have been removed from other patients and some steel braces. By glancing at these while I am instructing the child regarding the exercise and intimating that I may have to use them if she does not do what she is told, I make a stronger impression and the results are more satisfactory.

I say to the mother: "This scheme will not work unless we are dealing with an intelligent child." Need I say anything more?

Then I tell the child: "You take a little book in your pocket and you mark No. 1, 2, 3 and up to 10, and mark on that chart for ten days how many times you are going to test your-

self, and when you are going to test yourself." This is the crux of the whole thing. I want the child to test herself. I put down 7 a. m. or 8 a. m. or whatever it may be. I have the child bring me the record and I criticize it. Not that it makes a great deal of difference, but I am making a contact with the child. I want her to do that once an hour when she is awake. When she comes back in ten days I have a chart which tells me when that child made the test. The test is merely to raise the heels a little bit to see whether you have to raise the body.

If it is satisfactory, I make favorable comments. If it is not, I tell the child so. If one would do this ten times a day and test himself and try to keep his position, taking the exercise ten times in the morning and ten times in the evening, in ten days he will have done it 100 times and will have consciously taken a new position 100 times; that is habit. That is all there is to it.

If you want to add some postural exercise to this, very well; there is no harm in that. I think that is very good, but I claim that exercise per se is not necessary for the correction of this situation.

SUMMARY

An integral and very interesting part of the human body is the boney frame work of 200 or more bones, and how it is held together by muscles and ligaments to allow motion and to maintain an erect position of a tall, perpendicular mass sustained on a relatively small and changeable base.

It shall be our aim at this time to briefly discuss the matter of mechanics involving the maintaining of an erect attitude with the least possible stress and strain on the muscles, ligaments and nerves. We shall also present a method of teaching which seems particularly adaptable to instructing the individual, be it in the physician's office or on the gym floor.

Correct Attitude.—Many definitions have been advanced to convey the word picture as to what constitutes a so-called normal position, and though they may differ in detail all agree on the essential points. The main factors are to approximate as closely as possible the main segments of the body to a perpendicular line; to carry the body as tall as possible; and to maintain this position with ease and comfort.

Etiology.—Anything which for a more or less constant period deflects from the accepted normal position may be regarded as a contributory cause of the production of faulty posture. Among these may be mentioned defective ears, eyes, feet, short leg, tilted pelvis; also constitutional muscular weakness. The main factor, however, according to our theory, is bad postural habits and the changing of these bad habits into good postural habits, which constitute the essence of our theory in the matter of teaching good posture.

The Theory or Method of Teaching.—The underlying principles behind our method is that first of all the child must understand the methods involved in the question of bad posture. No amount of perfunctory commands to stand straight and do so and so will bring about good results unless the child knows exactly what is wrong. To supplement this it is our practice to teach the mother as well as the child, because in the last analysis the mother must be the teacher.

In order to bring this about we take three shadowgraphs of the patient. The first as the child habitually stands; the second the position the child assumes as the result of the mother's various commands to stand straight; and the third the best possible position which the child may assume with our assistance. Having these pictures before us we can easily analyze the methods of the various attitudes and explain to both mother and child the mechanical errors involved. We do this by means of a blackboard talk. Following this we give the patient instructions in the method of obtaining the best posture and appropriate exercise and elicit from her a promise of co-operation. The success of this method of teaching depends on the last analysis on the co-operation of the patient.

DISCUSSION

DR. JAMES C. ELSOM (Madison, Wis.): Dr. Ewerhardt called attention to the fact that poor posture is

not always a matter of muscles; it is a matter of habit. Sometimes it is a matter of musc.es, because of the fact that the large pectoral muscles in front are apt to be overdeveloped; everything that we do we do in front of us. The pectorals are constantly brought into play. The muscles that retract the shoulders are not so often used, and so it is often necessary to correct this muscular adjustment to correct or develop the antagonistic muscle.

Our attention was called to the fact that poor posture was hereditary. I believe in reality that has a good deal to do with the case. I have noticed in my own work in a great many cases that it seems exceedingly difficult to cure these defects of posture because, apparently. there is some hereditary transmission of either bony construction or muscle construction that brings about bad posture in the patient.

As previously stated, posture is often due to habit. The Germans say that it is most often due to weakness of will. I believe that has a very large grain of truth in it. In order to correct one's posture, I think there must be conscious muscular effort, a conscious feeling of posture. If you once get that habit it will be a very uncomfortable thing for you indeed, if you assume poor posture.

Dr. Ewerhardt has not said anything yet about abdominal ptosis as a result of these relaxed abdominal muscles, but I believe it is at the root of a great deal of digestive and intestinal ills. One of the favorite exercises that I give my patients is to ask them to walk upstairs, and while they are walking upstairs, to take this stretching exercise, trying to make themselves as tall as possible, and at the same time contracting their abdominal muscles. That in itself is a very good exercise. Also, I have often given this: I have one class in posture in which I can use some bricks, and I make each man put a brick on his head. One can't stand in very poor posture with a brick on his head, because immediately his head is going back, he will get the center of gravity and will hold the correct posture. This exercise is good when one walks upstairs. It brings about wonderful results. I have told these men: When you are walking along the street, if you happen to think sometimes that you are slumping, just imagine that you have got that brick on your head. I have had them tell me that sometimes when they are walking along the street, they think about the brick and their head goes back and the chest up, and they walk along imagining they have a brick on their head and that everybody owes them a dollar.

This idea of making yourself tall is a very splendid one. The conscious effort of stretching up to the ceiling is splendid.

Many poor posture cases have flat feet. Flat feet, in nine cases out of ten, the feet turn outward, and we have the splayfoot position, as we call it, the reverse of the toeing in. That, as you see, brings an undue strain upon the inner sides of the arches, and, that, as we know, is the weakest part of the arch. The The remedy is to turn the toes in when walking, or at least walk perfectly straight. Turning the feet out, in itself, leads to flat feet. The corrective exercise is to get rid of the pronation.

Here is a splendid exercise which I have recently come across. Do you know that flat feet in a great many cases, is due to the weakness of the muscles under the feet One of the exercises which I have recently tried is to have the patient walk barefoot over a ladder that is placed on the ground or on the floor. prefcrably out of doors. This summer, in a camp, I had the boys take off their shoes and walk on the rounds of the ladder back and forth. This is a very splendid exercise. because in the first place they have to be up on their toes; in the next place, as soon as their toes strike the rounds of the ladder, they curve right under and use those muscles which are neglected in all of us because of the fact that we all wear shoes, a very productive cause, I think, in improperly fitted shoes, of flat feet.

I am going to suggest to Dr. Ewerhardt a better thing. I am going to have two ladders and slope them so they touch at the top, and I am going to have the patient walk those ladders which are placed at an angle, so that he must take the position which relieves pronation.

Dr. B. N. Robinson (St. Louis, Mich.): I should like to ask the essayist what he thinks about the military regulations of the United States army, which demand that the man at attention should stand with his heels together and his feet at an angle of 45 degrees. In training a number of men who passed through my company, I found it was very, very fatiguing. I believe that is a very unnatural position.

Dr. F. H. Ewerhardt (Closing): That latter question can be answered by saying there are two things wrong with the position. One is that the feet are wrong; they should be parallel As Dr. Elsom explained, that is a position which tends toward a weakness of the long arch. When the long arch is out, your posture is out. When the long arch is bad and the feet are weak and painful, other parts of the body begin to readjust themselves to that position and you have all sorts of bad posture.

So far as the military attitude is concerned, this is my criticism: In the first place, it violates a very important part of a correct definition of posture, which is that the posture should be at ease. Any posture which demands strain is not natural and is not good posture. The body can be so placed, one segment over the other, that there can be perfect ease. Throwing your shoulders back with a pouting chest are not necessary. That is an exaggerated position and means noth-

ing. The one thing military discipline does, so far as posture is concerned, is that it demands an over-exaggerated position for so long that it does stretch these soft muscles. But as a posture, I don't like it at all.

Hereditary, congenital malformation are causes of ptosis. I have been talking principally about acquired posture. If I had two or three minutes I could talk to you about cases of lordosis and abdominal exercise.

QUESTION: Do you believe it possible to create a good posture and wear high-heeled shoes?

DR. EWERHARDT: A high-heeled shoe, when it has a very small base, which it so oftentimes has. is a very pernicious instrument of torture. If only women could understand that. If they could see as many of the women as I see who come in when they are 40 and 50 years old with a chronic backache and bad feet, largely as a result of wearing high heels with a small base. I think they would not do it. It is entirely contrariwise to good posture. Of course, remember, that once having worn a high heel for so long, you cannot jump down to a low heel with any degree of comfort. That has to be done gradually. Mechanically speaking, it is wrong.

PHYSICAL THERAPY CLINICS

ELECTROSURGICAL CLINIC

E. N. KIME, A.B., M.D., F.A.C.P., Director
Physical Therapeutics University and
Indianapolis City Hospitals.

Report of ten cases treated by electrosurgery under intravenous Somital.

The analgesic and anesthetic properties of sodium iso-amylethyl barbiturate (somital) have been outlined by Zerfas and McCallum.[1] The lethal dose for man is unknown, but for animals such as the rabbit, dog and cat it has been determined at about one hundred milligrams per kilogram of body weight. In man fifteen to twenty-five milligrams per kilogram of body weight has been found amply sufficient to produce surgical anesthesia, for an operation of the average length of time (about sixty minutes). The drug is administered intravenously in freshly prepared triple distilled sterile water, made up to ten per cent in strength, and administered at a rate no faster than one c.c per minute. "Within three to five minutes after the intravenous injection of the drug was begun the patient became drowsy and passed into profound sleep. Usually seven to ten grains were required to render the patients unconscious, although the amount varied in individual patients. As a rule, they were carried rapidly through the stages of anesthesia so that excitement, laryngospasm, etc., were rarely observed. Within ten to fifteen minutes time, the common reflexes were absent, except the pharyngeal, sphincters, and occasionally the skin reflex. Doses of fifteen to twenty grains produced light to deep surgical anesthesia within fifteen to twenty minutes, whereas smaller doses, such as five grains, produced analgesia without necessarily rendering the patient unconscious." The above excerpts from this preliminary report of Zerfas and McCallum, indicate the ease and comparative simplicity of this new method of inducing surgical anesthesia. The experimental work, both in the pharmacological laboratory and on the medical wards of the Indianapolis City Hospital, in the control of convulsions of strychnine poisoning, tetanus, and rabies, had by September, 1928, been carried on for years upon many carefully studied cases. By this time, a number of minor surgical procedures had been carried out with more or less indifferent success, but it remained for a hopelessly incurable case of cancer of the mouth, cheek, jaw and neck to offer the first occasion in which a regularly scheduled major surgical procedure was carried out. This is the first of the series of cases which I wish to report, and the

first recorded case in which intravenous somital was used for anesthesia in a major surgical case. This and the following similar cases were operated by electrosurgery through courtesy of the attending surgical staff.

Case No. 1—R. McD., white male, age 58. Admitted to hospital September 6, 1928, with extensive squamous celled buccal cancer of about four years duration. The neoplasm had ulcerated through to the external aspect of the cheek on the right side; both lips were involved, as was the mandible and the regional submaxillary and upper deep cervical nodes. Although manifestly hopeless so far as cure was concerned, a palliative operation was recommended to him for relief of sepsis and pain. This he very willingly agreed upon, even when warned that recovery from the operation was not likely. Formerly, operations (upon similar cases) had been carried out under various forms of anesthesia, or analgesia—all of them having one or other objection. For example, ethylene was never used because of the danger of explosion. Ether had been used but with considerable hesitation and loss of time in our efforts to prevent the same dire complication. Gas-oxygen anesthesia in addition to the possible danger of explosion, necessitates closed respiratory passages, and all of these inhalation anesthetics require the physical presence of the anesthetists hands about the anesthetic field. Chloroform is less objectionable from the above standpoints, but few anesthetists care to administer it, for reason of danger of cardiac depression and hepatic necrosis as a squelum that are well known to the profession. H. M. C. given hypodermatically in large doses produces a narcosis that will permit of a rapidly performed electrosurgical operation, but I have found it depressent in elderly individuals with cachexia. It is evident that any agent which will permit of sufficiently deep narcosis for surgery, which is relatively safe so far as cardiac depression is concerned, which serves as an antidote against the toxic effect of local anesthetic agents, and which offers no danger of explosions, and which eliminates the hands of the anesthetist from the operative field would be peculiarly valuable to the electrosurgeon in operations about the mouth, nose and air passages. It was with these facts in mind that this first patient was scheduled for somital anesthesia, in which the somital was intended for use as a preoperative analgesiac agent—to be followed by local anesthesia. The dosage chosen was twenty grains, and the induction was uneventful. Several minutes later, the patient showing no signs of consciousness, the attending staff held consultation with regards to the use of further anesthetic agent. Although there was some doubt in our minds as to the probability of success, it was decided to attempt to operate without injection of novacain, and much to our surprise and delight, there was no untoward reaction whatsoever. The patient's pulse and blood pressure continued at about the same as before operation; and it was not until the operation was almost finished that restlessness developed. We later learned that this would not have entailed any memory picture, but nevertheless in order to make certain of the success of the anesthesia, he was given an additional seven and a half grains and the operation completed. During the next thirty-six hours the patient was kept asleep with two additional injections of five grains each, at twelve hour intervals, and then allowed to awaken. There was no marked clouding of the sensorium. His restlessness was controlled by two injections of morphia grs. 1/6th each. There was absolutely no pain, and very little shock. The patient was able to be out of bed on the fifth day, and was helping about the wards by the third week. The operation had been extensive—removal of the right cheek, both upper and lower lips, and partial resection of the mandible. By the fifth week, however, the cervical nodes had begun to enlarge rapidly and it was necessary to reoperate extensively upon the neck. Also a first stage plastic repair was done. The same solution was used as was given five weeks bfore, but in dosage of thirty grains intravenously. So far as the anesthesia was concerned, this operation was as successful as the first one, but the after result was bad. The patient went into shock from which he could not be rallied. The pulse rapidly mounted to 160, the temperature to 106, and he died on the third day following the operation. We learned from our experience in this and subsequent cases to use dosages of not over twenty-five grains, also to

administer a fresh solution of the drug to each case.

CASE No. 2—Mrs. Mary K., white woman, age 73. Admitted September 21, 1928, with extensive negelcted ulcerating basal celled cancer of the head, face and neck. The orbit and antrum on the left side were involved. Palliative operation was done on October fifth. It was necessarily very extensive and although thirty grains of somital were used, this, together with the widespread involvement and the radical nature of the surgery produced too much shock and she died the day after operation, with symptoms very much the same as those exhibited by the first case. Unfortunately, in neither case was necropsy obtained.

CASE No. 3—Wm. W., white man, age 31. Radical resection of adenocarcinoma which originated in the alveolar mucosa, and had metastasized into the antrum, nose and cheek. Somital grs., twenty-three intravenously. Anesthesia good. The conditions remained very good for about twelve hours, but after this time the patient went into delayed shock, the pulse rapidly mounting, and blood pressure and temperature rapidly falling, and despite the administration of caffeine sodium benzoate grs, xv, the patient died.

CASE No. 4—J. McG., white woman, age 42. Extensive recurrent cancer of the left breast. Previous operation seven months before at City Hospital. This patient was operated by me as private patient at the Christian Hospital. Owing to the rapidity of growth, and the widespread metastases a very gloomy prognosis was given, but palliative operation performed for relief of pain. Under somital grs. xx i. v. followed by very light administration of ether, a very radical ablation of all tissues from the clavicle to the sheath of the rectus, and from the sternum to the left posterior axillary fold was done. The axillary dissection was exceedingly difficult and tedious, but the anesthesia was perfect. In this case the blood pressure determinations were carefully done before, during the induction of the sominal, and during the operation. The readings were 100/80 before somital, and the injection was stopped at 80/60, at which time twenty grains had been given. Shortly fter the operation was begun the blood pressure had returned to 100/80. Although the operation was not accompanied by much blood loss, and although at the end of the operation the blood pressure was still 100/80, the pulse had increased from 90 to 130, and somital depression was feared. Despite the usual precautions against the development of shock, which included external heat, shock blocks, and hot coffee per rectum, the depression became more and more profound, so that four hours after operation the patient was almost moribund. The pulse was too rapid to count, the blood pressure too low to be estimated, and the temperature 96.0 F axillary. Drastic measures were indicated. Experimentally in somital poisoning in animals the injection of caffeine sodium benzoate and ephedrine had proven to be of great value in combating the depression of the nervous system and blood pressure associated with somital poisoning. It was decided to use these two drugs in combination—consequently caffeine sodium benzoate grs. xv, and ephedrin sulphate minims xxv were given hypodermatically. The results were brilliant—within a few minutes the blood pressure arose to 120/80, the pulse became strong and could be counted at 120 and the temperature became normal. Following intravenous injection of glucose and normal salt, and one blood transfusion (600 c.c. whole blood) and a repetition of the caffeine and ephedrine twice each twenty-four hours for three days, the patient made a satisfactory recovery.

CASE No. 5—Mrs. H. B., colored woman, age 45. Rectal stricture and extensive pararectal condylomatous masses. Intrapelvic pathology—Neisserian infection. Blood Wassermann negative. Electrocoagulation of part of the condylomatous mass and ordinary cautery excision of the rest, in order to determine the relative efficiency of the two forms of thermodestructive technic. Anesthetic agent—somital grs. xv. i.v. Anesthesia very good, after result very good. Sodium benzoate of caffeine was used as prophylactic against somital depression, and was administered immediately following the end of the operation.

CASE No. 6—Mrs. M. H., white woman, age 40. Spindle celled sarcoma of the left upper jaw antrum and cheek. Recurrent after cautery excision, x-ray and radium therapy. Patient weighed over 200 lbs, epileptic, and having frequent convulsions—aggravated by the constant pain in her face. Palliative electrocoagulation of sarcoma of jaw, and cheek under somital grs. xviij i.v. In this case a preanesthetic narcotic, morphia grs. ¼ was given. Anesthesia satisfactory, and the patient awakened free from pain and mentally clear some fifteen hours after the operation ended. There was no shock—since caffeine sodium benzoate grs. xv. had been administered. After awakening she was given amytol by mouth for restlessness, and left the hospital on the tenth day.

CASE No. 7—A. C., white man, age 68. Squamous celled carcinoma of the lip, recurrent one year following the usual type V resection of lower lip. Submaxillary and upper deep cervical nodes involved. In this case postoperative radiation had been advised by the surgeon but refused by the patient for some reason known only to himself. Owing to the nature of the case, and the extent of the cervical metastases, a grave prognosis was made, but a palliative operation for relief of pain agreed upon. He was operated by endothermic knife technic on the same day as the preceding patient (12-14-28) under morphia grs. ½ and somital grs. xv i.v. The anesthesia was satisfactory, even though a full sixty minutes was required for the block dissection of the neck, the ligation of the external maxillary artery and external jugular vein, and the ablation of the cancer of the lip. Caffeine sodium benzoate grs. xv was administered, and the patient awakened mentally clear in about six hours. He was ambulatory the sixth day and dismissed on the tenth day. Convalesence uneventful—no morphia needed for pain. Cervical incision healed per primum.

CASE No. 8—E. A., colored woman, age 30. Extensive venous angioma entire right cheek. Recent rapid increase in growth, so that the overlying skin and underlying mucosa were both put upon tension and a swelling was noticed both externally and internally. Electrosurgical excision by endothermy knife without ligation of any vessels. Somital anesthesia grs. xv, preceded by morphia grs. ¼. Awakened the next day after the operation somewhat hazy mentally, but left the hospital on the fourteenth day, and except for moderate scar tissue retraction in the cheek, has had very satisfactory after result.

CASE No. 9—W. B., white man, age 65. Cancer of mouth, cheek, lower lip and mandible. No palpable nodes. Electrosurgical resection en masse under somital grs. xviij, preceded by morphia grs. ¼. Blood pressure, which was 120/80 at beginning of operation, remained unchanged. Patient ambulatory in forty-eight hours, with blood pressure 135/90 in sitting position. No after pain, and no complaints except that of obtaining enough nourishment.

CASE No. 10—E. A., colored woman, age 30. Service, Dr. C. P. Clark, and operated by Dr. Clark and myself under sominal grs. xv i.v. The lesion has not been reported as yet, since the entire eye is being sectioned under celloidin and several weeks are required for report. However, the clinical diagnosis is squamous celled carcinoma of the cornea. The duration of disease is short, being less than two months before operation. The lesion apparently started in the conjunctiva just lateral to the limbus, and spread rapidly across the cornea until it covered three-fourths of the transverse diameter of the eyeball. In this case the classical enucleation of the eyeball was possible, utilizing the endothermic knife or needle electrode. The anesthesia was perfect, and the operation a technical success in every way, both during surgery and postoperatively. Uneventful recovery, patient left hospital on the tenth day.

SUMMARY AND CONCLUSIONS

1. Ten cases of neglected, extensive, recurrent, radiation resistant or otherwise inoperable neoplasms are reported in which the combination of electrosurgery and intravenous somital anesthesia was used.

2. This series includes the first major surgical operation ever done under intravenous somital, a palliative electrocoagulation for relief of sepsis and pain in a hopelessly incurable case of neglected buccal cancer, with extensive in-

volvment of cheek, both lips, mandible and cervical lymph nodes. The first stage operation was a brilliant success, in which both the depth of anesthesia and the immediate result exceeded our fondest hopes.

3. Following this initial success in a case wherein there was nothing to lose and everything to gain, other surgeons were encouraged to use somital in a wide variety of cases, including goiter, chest, abdominal, pelvic, orthopedic operations, and also in obstetrics, both for pathological as well as normal deliveries.

4. In electrosurgical cases or in cases where the actual cautery is used with danger of explosion, and especially in lesions about the mouth and head, this technic has given promise of great value.

5. In this series of ten cases, the immediate mortality in otherwise incurable lesions has been thirty per cent. Since these were the earliest cases in the whole series, in all of which doses over twenty grains were used, and in none of which the experimentally determined antidote had been used—(caffeine sodium benzoate grs. vx (h) and ephedrin sulphate minims xxv (h) it seems reasonable to conclude that with smaller initial doses of somital (from fifteen to twenty grains, in proportion, not to exceed fifteen milligrams per each kilogram of body weight) that the mortality should be greatly reduced. Especially is this true, since with electrosurgery, two or three stage operations may be performed with less danger of recurrence than after the ordinary procedure.

6. In seven cases out of this series, in individuals not so hopelessly involved, and in which dosages of less than twenty grains of somital were used, and also in which the exhibition of caffeine sodium benzoate and ephedrin started immediately after the termination of a relatively short operation—the after results as well as the anesthesia itself could hardly have been improved upon.

References

—*Zerfas, L. G., and J. T. C. McCallum.* The *Analgesic and Anesthetic Properties of Sodium Iso-amyl-ethyl Barbiturate. Jour. Ind. State Med. Assn., Vol. xxii, No. 2, page 47.*

EDITORIAL

ARCHIVES OF PHYSICAL THERAPY, X-RAY, RADIUM

Eighth Annual Meeting,
November 4, 5, 6 and 7, 1929,
Hotel Sherman,
Chicago.

ULTRAVIOLET THERAPY IN THE KING'S ILLNESS

The utilization of ultraviolet radiation on his English majesty George V, during his recent illness was a radical departure from established and orthodox methods. At the time when phototherapy was introduced into the medical regime of this distinguished patient his condition was decidedly critical. It required courageous decision at such a moment to introduce a remedy considered by some as more or less theoretical in nature. The decision for its selection was entrusted to a group of distinguished specialists whose courage at the crucial moment was typical of their British heritage. The situation was unusual in more than one way. The patient, one of of the most distinguished personages of our day, was at the time suffering from a series of complications, any one of which was of sufficient gravity to give sober pause to the most optimistic medical attendant. Aside from grave complications of chest and heart, the patient according to reports was known to have been a sufferer from diabetes for many years. It is therefore interesting to read the editorial in the February number of the British Medical Journal and to note the reasons that prompted the introduction of ultraviolet radiation in the face of a febrile and moribund state.

Commenting briefly on the subject, the British Journal of Actinotherapy and Physiotherapy of March 1929 quoted the foregoing editorial as follows:

"The part played by actinotherapy in the King's illness and the reasons which indicated the choice of technic and apparatus are best summed up in the following extract from an editorial in the British Medical Journal (February 9, 1929) whose comments are based on authoritative information.

When the decision was first made to employ ray therapy in the treatment of His Majesty the choice of method was determined by two considerations. For clinical reasons the exposures could be made only for short periods of time and applied only to small areas of the body surface, in order to reduce the degree of disturbance to a minimum. It was accordingly decided to use the mercury vapour lamp, with the object of sitmulating parathyroid, adjusting calcium metabolism, rectifying the leukocyte count, and raising the bactericidal power of the blood. At the more serious stage of the illness this type of lamp, which emits a rich supply of ultraviolet rays, was therefore judged to be the method of choice. There is reason to think that the progress that occurred during the period of application of such measures was in part due to them. The improvement now attained renders possible treatment by carbon arc with its more penetrating luminous rays, whose energy, it may be hoped, will become converted to the use of the body, and thus favour the action of sea air, sunlight and change of scene.

Although in the case of a serious illness it is difficult to attribute progress to any one out of several thereapeutic methods employed, it will be seen from the foregoing that the use of actinotherapy was fully justified by the part it played. As we have said before, this recognition of its place in modern medicine will be a decided encouragement to all who have devoted time and thought to studying and practicing this method."

In America, at least, opinion is fairly unanimous as to the futility of ultraviolet radiation in severe affections associated with temperature. It is usually accepted as a contra-indication to radiate patients that are acutely ill, on the as-

sumption that the chemical processes are already abnormally increased and that the defensive forces of the body are in a state of greatest activity. Under such conditions it is decidedly better to omit the stimulating effect of ultraviolet. Where, however, as in the case of this distinguished patient, the defensive forces are at low ebb, modified ultraviolet radiation is decidedly indicated. Short exposures over small areas of body surface is to be preferred and the irradiation must be of sufficient intensity to produce a stimulating effect. The function of the kidney is thus undisturbed, the blood platelets are increased and flagging metabolism is gently whipped up and improved. The possibilities of this modified form of ultraviolet therapy are vast and it is particularly indicated in the approaching moribund state. It has been frequently neglected not because of a lack of appreciation of its great value, but because our attention has inadvertantly been focused by a rich and rapidly accumulating literature on other phases of therapy by ultraviolet.

While no formal conclusions can be drawn from a single experience no matter how outstanding the circumstance, it has however produced thought provoking effects. The picture of a notable group of selected physicians deliberating, consulting and planning the modified quartz light treatment to his majesty is one that cannot be easily forgotten. Just as it has provoked thought so it is to be hoped it will also stimulate discussion and scientific investigation in selected circles. What is most needed now is confirmatory evidence from other sources-evidence backed up by proper control measures.

D. K.

ANNUAL MEETING

Again Chicago has been selected for the annual meeting place. The successes of previous meetings, the facilities of the hospitals and clinics and the ease with which Chicago can be reached from practically any section of the continent, make it ideal for convention purposes. Added to these numerous features is the fact that Chicago offers also the best hotel and exhibition facilities.

As in the past the purpose of the congress is to offer the highest type of a scientific program. The plan this year is to make the meeting more clinical in nature. In line with this plan half the time of the entire session will be devoted to clinics. These will be conducted by experienced teachers, the majority of whom are affiliated in some way with teaching institutions. Each clinic will be carefully planned and every possible means of demonstration and illustration will be brought into play. Technic and methods are to be emphasized, omitting claims as to results, leaving these to the observations of the doctors who will later judge by their own experiences. Thus the clinics will act as substitutes for the instruction classes conducted during the past three annual sessions.

The afternoons will be given over to scientific papers and clinical addresses. Sectional gatherings will rule as heretofore, except for the last day when a point meeting of all sections will be held. At least part of this joint session will be devoted to a symposium on physical therapy education. This subject is of vital importance and calls for a great deal of discussion from those interested in physical therapy.

The exhibits as usual will comprise an important part of the convention. All that is new in equipment and apparatus will be displayed by America's leading manufacturers and dealers.

The program committee is now busily engaged in organizing the sectional programs. Fellows of the college and others who have scientific papers to present are asked to send in titles with short abstracts, at the earliest possible time. The preliminary program will be ready by June first, therefore prompt action for those desiring to participate is now necessary. All correspondence should be conducted with Miss Lucille White, Executive Secretary, American College of Physical Therapy, Suite 716-30 North Michigan Avenue, Chicago.

EFFECTS OF RAYS ON TISSUES

The investigators of the use of ultraviolet rays have been attempting to determine whether the effectiveness is dependent on the length of

the wave used or on the dosage of rays given. The factor which decides whether the effect of the ray is to be stimulative or inhibitive seems to depend on the quality rather than on the quantity. A number of investigators, including some of the leading men in the field, have found that it is possible to produce both types of effect with the same region of the spectrum and they argue that the matter of dosage is of the greatest importance in determining whether the effects shall be stimulation or depression.

In order to study the matter more closely, Dr. Marie A. Hinrichs of the University of Chicago tested the effects of radiation on growing yeasts. Earlier studies reported that the exposure of growing yeasts to ultraviolet radiations produced only depression of the sugar-fermenting power. The newer investigators indicate that either stimulation or depression may be produced, shorter dosages giving stimulation and longer dosages giving depression. After an interval of several hours or longer the substances return to the normal, but in some cases permanent inhibition followed and recovery did not occur. When the effects were temporary, a gradual return to normal was found to be followed by a slight advance beyond the normal in the other direction.

After the work with yeast was completed, studies were made on the effects or radiation on cell division, on embryologic development, and on physiologic process. In every experiment it ws found that short exposures to radiation stimulate and longer exposures depress the activity.

SCIENTIFIC AMERICAN, Morris Fishbein, M. D., March 1929.

WHAT THINGS ARE MADE OF?

The tangible objects with which we are familiar we find constituted of molecules. These, in turn, are composed of atoms and these of positively charged and massive protons and the negatively charged and mobile electrons. The light which makes plants grow and which gives us warmth has the double characteristics of waves and particles, and is found to consist ultimately of photons.

Having carried the analysis of the universe as far as we are able, there thus remain the proton, the electron, and the photon—these three. And, one is tempted to add, the greatest of these is the photon, for it is the life of the atom.

We sometimes think of standardization as being the distinctive keynote of modern industry. But even a Ford car has hundreds of parts that differ from each other. What, then, shall we say of the Workman who by using only three different parts, protons, electrons, and photons, has made a universe with its infinite variety of beauty and life?

SCIENTIFIC AMERICAN, Arthur H. Compton, Ph. D., March 1929.

ELECTRONIC BOMBARDMENT SAID TO SYNTHETIZE RUBBER

SYNTHETIC rubber enthusiasts may get fresh encouragement from the announcement that in Germany, H. Plauson, noted physicist, has discovered a mode of producing chemical rays through a modification of the Coolidge and Leonard tubes that can polymerize isoprene, butadiene, and their homologs and analogs to caoutchouc with great rapidity, and that can even convert rubber solutions into an insoluble state without the use of sulfur.

From the purely scientific standpoint the report is perfectly acceptable, but it should be taken with the realization that the path from the physical laboratory to the rubber tire factory is long and torturous and beset with many dangers.

CHOLESTEROL AND SENILE CATARACT

In a paper on some observations of the blood chemistry in patients with senile cataract, O'Brien* and Myers point out the possible relation certain blood constituents may have in the production of cataracts. They note previous studies of Cohn in which the increase in all lipids was observed in lenses exhibiting cataractous changes. Cholesterol, lecithin and fats were increased. For instance, cholesterol shows 6.22 per cent per hundred parts of the sole residue of cataractous lenses, while in nor-

mal lenses it is only 0.62 per cent per hundred parts.

Blood chemistry was traced out along definite lines in fifty-four cases with cataract. The findings were quite valueless, except that cholesterol was increased in 54 per cent of these cases.

PHYSICAL THERAPY COURSE

Northwestern University Medical School is offering a course in physiotherapy to qualified practitioners of medicine. The course will be given beginning May 13, 1929. Registration will be limited to twelve and will be closed upon the receipt of the full number of reservations. Reservations will be made upon receipt of a deposit of $25.00 which deposit will apply upon the fee for the course, which is $150..00.

The important point emphasized in this course is that training in physical therapy by clinical observation alone is unsatisfactory and that there must be instruction in the physical and biological principles involved.

The teaching will consist of lectures, observation of cases, their physical therapeutic presciptions, demonstrations of technic, clinics and actual treatment of cases under supervision.

The lectures will be given by the staff of the Northwestern University Medical School. The cases observed and actually treated will be at the clinic of the school. The clinics will be given by the members of the staff of the school at affiliated hospitals.

Apply to Irving S. Cutter, M. D., Dean, Northwestern University Medical School, 303 East Chicago Ave., Chicago, Illinois.

BORDEAUX COURSE, EAR, NOSE AND THROAT

We have just received the announcement that Ear, Nose and Throat Post Graduate Course will be given at the University of Bordeaux, France, commencing July 22, 1929. This course consist of Surgery of Ear, Nose and Throat, Trans-mapillary and Plastic Surgery, Bronchoscopy. Leon Felderman, M. D. of Philadelphia, Pa. is representing this course.

ONTARIO DENTAL ASSOCIATION

The sixty-second convention of the Ontario Dental Association will be held at the King Edward Hotel, Toronto, May 27, 28, 29, and 30, 1929. Members of the American Dental Association and state societies are cordially invited as guests.

Fred J. Conboy,
Secretary-Treasurer.
The Ontario Dental Association,
East Block, Parliament Bldgs.,
Toronto, Ontario.

THE STUDENT'S LIBRARY

BOOKS REVIEWED

PHYSIOTHERAPY IN GENERAL PRACTICE AND FOR THE USE OF MASSEUSES. By *E. Bellis Clayton*, M. B. B. Ch., Cantab. Dir. of Physiotherapy Department, and in charge of the Massage and Practical School, King's College Hospital, London; second edition; 226 pp. illustrated. William Wood and Co., Publishers, N. Y.

TEXTBOOK OF CLINICAL NEUROLOGY FOR STUDENTS AND PRACTITIONERS. By *M. Neustaedter*, M. D., Ph. D., Visiting Neurologist, Central Neurological Hospital, Welfare Island. With an introduction by Edward D. Fisher, M. D. Cloth. Price $6.00 net; Pp. 602, with 228 illustrations. Philadelphia, F. A. Davis Co., 1929.

.... This is an excellent book for the general practitioner and the physician interested in physical therapy. The symptoms found at the bedside constitute the chapter divisions, and under these are discussed the various diseases exhibiting such symptoms. This is valuable for the general practitioner in making his diagnosis, es-

perially as methods of neurological examinations are fully considered.

For those interested in physical therapy this book will be helpful as it gives under each condition the physical agents useful in its treatment.

THE NORMAL AND PATHOLOGICAL PHYSIOLOGY OF THE BONE. By *R. Leriche* and *A. Policard*, Pp. 236. St. Louis, C. V. Mosby Co., 1928.

This volume deals with the problems of bone production and resorption, the function of the periosteum, the repair of fractures, the physiological problems of bone transplantation and grafting discussing many mooted subjects. The authors state clearly their own opinions and reasons for their adoption.

It is translated by a radiologist and an orthopedist. A bibliography of 250 titles is appended. Every one interested in bone pathology should include this volume in his library.

INTERNATIONAL ABSTRACTS

The Treatment of Malignant Neoplasms with Colloidal Lead. D. S. Pulford and J. D. Lawson. Am. J. Roentgenol., 20:456-461, Dec., '28.

Of eleven patients with malignant disease treated with colloidal lead intravenously, 9 are dead and the other 2 unarrested. Two of them showed definite signs of tumor regression before death. The colloidal triortho lead phosphate as furnished by Bischoff is nontoxic if used in single doses up to 100 mg., but dangerous in its cumulative effect.

It is our opinion that a safe dosage is 50 mg. every second or third day up to 200 mg., further injections being judged safe or not by the degree of basophilic stippling of the red blood cells. However 100 mg. doses given at weekly intervals up to 500 mg. has not proved harmful. So from 1 to 1.5 mg. per kilogram body weight may be considered a safe range. Very little anemia was caused by this solution of lead and no serious kidney damage was noted. The bromsulphphthalein liver function test did not give evidence of liver damage. There are not sufficient data at hand to say whether or not the degree of malignancy plays a role in the cancer cells affinity for lead. Lead can be remobilized from bones by ammonium chloride acidosis and also by Collips's parathormone, extract of the parathyroid gland.

A Simple Radium Carrier and Filter Giving an Easier Approach to Neoplasms of Difficult Access. S. L. Warren. Am. J. Roentgenol., 20:563-569, Dec., '28.

Lead tubing of 5 mm. bore and .45 mm. wall has a wide range of usefulness as a radium carrier and filter combined with a flexible handle for fixation. It is easy and simple to prepare requiring few tools, and is unusually inexpensive. The tubing is flexible, interferes with normal function to a minium, and is convenient to apply and fix in place without pain. It has found its greatest use as a carrier and filter in treatment of growths of the face, mouth, nose and throat, esophagus, rectum, bladder and cervix.

Roentgenography in Its Relation to Clinical Findings in Pulmonary Tuberculosis. A. G. Schnack. Ann. Int. Med., 2:763-770, Feb., '29.

Much confusion exists in the interpretation of roentgenographic lung findings. Much of this confusion can be cleared up by learning the fundamental principles which are responsible for these findings rather than by trying to master pictures supposedly characteristic of different types of tuberculosis. We attempt roentgenographically and by clinical means to determine the same thing, namely, the "activity" of a lesion. Exudate about a lesion signifies activity, and this exudate depends in great measure upon the developed allergy. The individual "reaction factor" to disease is a most important consideration. As the activity or exudate subsides, we find corresponding evidence in our roentgenograph, which presents the actual pathological process to us. The evidence often cannot be obtained by other means. Numerous other factors must, however, be also considered in prognosis.

Cholecystography. T. H. Sharp. Texas St. J. Med. 24:644-647, Jan., '29.

The continued and increasing use of tetrahalogenphenolthalein dye substances in cholecystography is sufficient proof of its real value. Of the two methods of administering the dye substances, I regard the oral by far the more desirable in the great majority of cases. There are very few contra-indications to the oral administration of the dye, the most common one being pyloric obstruction which would prevent the capsules from reaching the intestinal tract. Pregnancy and ordinary heart lesions offer no contra-indications to its use. A definite routine in carrying out the examination should be established and strictly adhered to in order to get uniform results. Reactions, following the oral administration of the dye, are usually mild, while the intravenous method occasionally produces a severe reaction with alarming symptoms. Cholecystography requires extreme care if good results are to be obtained. When a gall-bladder is reported normal by the roent-

genologist, I do not believe an operation is justifiable without exceptionally clear clinical evidence of gall-bladder disease. When disease of the gall-bladder is reported as questionable, the treatment should be based on the history and clinical symptoms.

Gallbladders which show irregular outlines in the radiogram that are due to adhesions, but which are functioning normally, should be left alone. When there is doubt as to whether stones are in the gallbladder or kidney, the author always advises a pyelogram to definitely determine their location. He regards the absence of a gallbladder shadow as being strongly indicative of a pathologic condition either in the gall-bladder, cystic or common duct. He has found that the cholecystographic findings agree with the clinical in most cases. The history and physical examination should be the determining factors in deciding on operative measures. Roentgen examination of the liver and gall-bladder is yet in its infancy.

Acute Osteomyelitis. D. Lewis. J. A. M. A., 92:783-786, Mch., '29.

Lannelongue and Achard, in 1890, made the first communication relative to streptococcic osteomyelitis. Lexer also has contributed a great deal to the knowledge concerning osteomyelitis. Osteomyelitis in the adult differs considerably from that in children. It is more frequently seen in children and the initial focus in the adult no longer occurs in well defined location. Owing to careful roentgen studies considerable light has been thrown on the manner in which the disease spreads. According to Starr, it is possible to demonstrate and has been demonstrated that the chief and early spread of osteomyelitis is not toward the medulla as has formerly been thought, but it is by way of the tissues of the metaphysis to the periosteum. A report is given on 229 cases of ostemyelitis. About 50% were discharged as improved. There is a difference of opinion as to the method of operation. Early diagnosis is a great factor in curing this disease.

Routine Use of Vitamin B Factor in Infant Feeding. R. H. Dennet. J. A. M. A., 92: 769-772, March, '29.

The author agrees with Macy & Hoobler that cow's milk, and in some instances, breast milk, does not contain the optimal quantity of vitamin B. Some vitamin B factors besides that contained in cow's milk should be added as a routine to the food of all bottle fed babies, just as cod liver oil and orange juice are universally used.

One third ounce by weight, or one level tablespoonful of wheat germ sugar, provides as much of the antineuritis factor as one quart of milk, and as much of the pellagra-preventing factor as ten ounces of milk. This sugar is more conveniently used, and more easily available than yeast. The author is of the opinion that from one to three tablespoonfuls from one-third to one ounce by weight should be given daily to every bottle fed baby throughout the first year of life.

Urinary Lithiasis. W. J. Erickson. Urol. and Cutan. Rev., 33:163-168, March, '29.

Every patient with symptoms referable to the genito-urinary tract and also those presenting vague abdominal symptoms should be carefully studied for urinary lithiasis. Complete urological study is the key to diagnosis. This study must include cystoscopy, pyelography, ureterography, kidney function and complete chemical, microscopical and bacteriological study of the urine from each kidney. Follow-up observation and treatment over a prolonged period of time, even after calculi have been removed, should be carried out. Logical conservatism should replace impetuous radicalism in the treatment of urinary lithiasis.

Perforated Peptic Ulcer. P. Platon. Long Island Med. J. 23:145-150, March, '29.

From the follow up work done on 41 cases of perforated peptic-ulcer treated surgically only nine could be considered as excellent results when the treatment consisted of cauterization and closure of the perforation. All of those cases of perforation treated by closure of the perforation and gastroenterostomy have obtained a perfect cure. Simply packing against the perforation has obtained a good result in one case. Peritonitis did not develop in any of the cases who had gastroenterostomy done.

Physical Therapy in the Treatment of Chronic Rheumatism. F. D. Howitt. Brit. Med. J., 1:338-341, Feb., '29.

An attempt has been made to summarize the various aspects of the treatment of "chronic rheumatism." Such treatment must necessarily follow a complete investigation in all cases, and must proceed along systematic lines. Drugs should be used, but not abused, particularly in the relief of pain. Members of the phenazone and exalgin groups, and salicylates, are the most valuable. Iodides probably owe their reputation to their effect in cases associated with endocrine disturbance, but are not so helpful as thyroid extract. Stock vaccines and other protein injections act by producing protein shock and are useful in certain cases. Autogenous vaccines would not appear to have any special advantages. It is suggested that chronic rheumatism is an allergic state produced by a number of widely different antigens in a susceptible subject. For this susceptibility the habits and necessities of modern civilization, especially inadequate stimulation of the skin, are largely to blame. Physical therapy owes much of its success to the rectification of these errors.

Effect of X-Radiation on Crystalline and Dissolved Sucrose. M. C. Reinhard and K. L. Tucker. Radiology, 12:151-153, Feb., '29.

X-rays color crystals of sucrose reddish-brown. These crystals when dissolved show measurable amounts of invert sugar. The production of invert sugar in sucrose solutions by x-rays is not satisfactory for dosage measurements because the amount formed with

therapeutic doses is too minute for exact determination. The amount of invert sugar formed is not proportional to the concentration of sucrose but proportional to the time of exposure. X-rays have no effect on solutions of invert sugar indicating a secondary effect on the sucrose.

Systemic Aleukemic Lymphomatosis. B. F. Schreiner. Radiology, 12:127-135, Feb., '29.

Two cases showed hematological pictures of aleukemic leukemia and subsequently chronic leukemic blood findings. Radiation in sufficient quantity, from 30 to 65 per cent of the skin erythema dose, will cause a disappearance of the enlarged tumor masses or nodes. Radiation in these cases must be controlled by blood counts. A disastrous keukopenia must be anticipated.

Roentgen Findings in Some Obscure Kidney Lesions. W. B. Bowman and L. S. Goin. Radiology, 12:188-192, March, '29.

The author suggests that a complete genito-urinary examination including roentgenograms before and after injection of the kidneys and ureter be undertaken in all cases with unexplained abdominal pain; that when indicated, such an examination should include pyeloureterograms with the patient in the upright position, and finally, that many cases present highly atypical findings which require much careful study and consultation with the urologist for their correct interpretation.

Routine X-ray Examination of Digestive Organs. A. L. Soresi. Med. J. and Rec., 129: 203-208, Feb. 20, '29.

Roentgenological investigations should be done with the patient in the erect position. The horizontal position gives incomplete, false, unreasonable information. The roentgenological study of the digestive organs should report the shape, position, behavior of each organ not only singly, but specially in relation to the other organs. Consequently, pictures of the different organs should be obtained together on each film. Stereoscopic and motion pictures should be taken in order to know the real relation of different organs to each other. The barium meal should be improved by giving the patient something palpable and which will help to study the real function of the digestive organs, which is digestion of foodstuff with adequate elimination of refuse.

Malignant Tumors of the Female Breast. G. V. S. Smith and M. K. Bartlett. Surg. Gynec. Obstet., 48: 314-320 March, '29.

This report covers a clinical pathological study of 234 malignant tumors of the female breast of which 2.9 per cent were sarcomata, the remaining being carcinomata. Nearly 60 per cent of patients were between the ages of 45 and 65 years. A family history of malignant disease was given by 16.7 per cent of patients. Nine patients had had previous breast operations, only one of which was carcinoma, so far as could be determined. The average number of children per married patient was 2.3. It was found that 23.9 per cent of patients had had only one child and that at least 36.7 per cent of the entire series had never nursed. Practically all of the patients complained of finding a lump in the breast. The duration of symptoms was usually under two years. Seven patients had had symptoms for more than seven years, which makes it probable that a benign tumor antedated the malignant disease. In untreated cases the course of the disease varied from one year and one month to seven years and three months.

The Roentgenological Diagnosis of Gall-bladder Disease. J. Friedmann. Med. J. and Rec., 128:588-590, Dec. 5, '28.

Cholecystography is still in the experimental stage; always examine by the direct method; if no calculi are found always examine the gastro-intestinal tract; the artificial visualization of the gall-bladder has greatly increased the accuracy of biliary diagnosis; this method assists in making visible a larger percentage of gall-stones than is otherwise possible.

A Comparison of Practical Methods of Measuring Roentgen Ray Quality for Therapy. E. H. Quimby. Am. J. Roentgenol. 21: 64-72, Jan., '29.

Three methods of quality determinatin of roentgen rays were compared quantitatively. These are: absorption coefficients referred to 0.1 mm. of copper, half-value layer in copper, effective wave length as determined by absorption in 1 mm. of copper. By each of these standards, a set of four equivalent radiations was established, at voltages from 125 to 200 kv., with the necessary copper filters to correspond to 0.22 mm. for 200 kv. in each case. The absorption of these "equivalent" radiations was measured in lead, copper, aluminum, and rubber, the last being used as an approximation to tissue. Radiations established as equivalent by the absorption coefficient referred to 0.1 mm. of copper were found to be equivalent as regards their absorption in rubber; those whose equivalence was established by greater testing thicknesses of copper were found equivalent as regards their absorption in correspondingly denser substances. Absorption coefficients or effective wave lengths may be measured with reference to any desired thickness of copper as a standard. Each different thickness will give different results. Therefore, when either absorption coefficient or effective wave length is given to define the quality of radiation, the thickness of copper used for the determination must be stated.

Curves are given for finding either the absorption coefficient or the effective wave length, when the measuring thickness of copper is 0.1 to 0.25 mm. Curves for any other thickness of copper can be obtained from Richtmyer's formula. Radiations from two different makes of mechanical rectifier machine were compared. For the same voltage and filter, the quality as deterwas the same, and these equivalent radiations were absorbed equally in rubber. It is therefore concluded that

for machines of the mechanical rectifier type, the quality is sufficiently determined by a statement of the voltage and filtration. However, difficulties in the exact measurement of voltage make it desirable to add some further specification. For this purpose, the absorption coefficient referred to from 0.1 to 0.25 mm. of copper, or the effective wave length as determined by absorption in such a thickness is recommended. Either of these necessitates the making of only one additional measurement.

Ureteral Obstruction in Infancy. M. F. Campbell and J. D. Lyttle. J. A. M. A., 92:544-550, Feb. 16, '29.

Approximately 2 per cent of infants suffer from ureteral obstruction which predisposes to infection and renal destruction. That pyuria which resists systematic therapy for more than four weeks indicates complete urologic investigation is our emphatic opinion. With this as our criterion, we have disclosed gross urinary tract disease in more than 95 per cent of the patients whom we examined. The same urologic, diagnostic and therapeutic procedure followed in adults should be employed for children and infants except when rendered impossible by the small caliber of the instruments.

Physical Means in the Treatment of Arthritis. F. W. Ewerhardt. J. Missouri St. Med. Soc., 26:7-12, Jan., '29.

Having thus reviewed the various methods which may be employed in the treatment of arthritis, we shall conclude by presenting a typical plan of treating a case of chronic periarthritis of the shoulder, with adhesions, limitation of motion and muscular spasm. It may serve as a general outline and may be modified to suit various conditions.

Diathermy is applied to the joint, using one of several recognized methods of technic, for from twenty to thirty minutes, being guided by the size of the electrodes, the amperage and the tolerance of the patient. This is followed by manual manipulation of the joint in all directions. Generally there is limitation of abduction, external and internal rotation of the arm; or perhaps the choice is in the selection of the low wave current to produce muscular contraction, using the galvanic or alternating current. The diathermy has produced a deep congestion and the manipulation possibly a minor hemorrhage, resulting in temporary increase of pain. It is well at this time to use either the radiant lamp or infra-red to relieve both the deep seated congestion and the pain. This should be followed by gentle sedative massage. At this stage we introduce whatever exercises seem indicated, the period lasting from one-half to two or three minutes and is followed by a Scotch douche, using water at a temperature of from 105 to 115 degrees and dropping to from 70 to 40 degrees, depending entirely upon the type and on condition of patient we are dealing with. This bath consumes three or four minutes. The douche is preceded by an electric light cabinet bath once or twice a week and the patient may or many not receive in addition ultraviolet radiation. Should there be an increase of pain the following day the manual manipulation and exercise will be omitted or decreased in intensity. The number of treatments may be three to six per week until improvement indicates a decrease.

This entire procedure takes from one to one and a half hours. The results are usually good from the viewpoint of relieving pain and increasing the general well-being of the patient. We speak with less assurance with respect to contractures and ankylosis; in some instances we have had very good results, in others no definite improvement.

Comparison of Leukoplakia, Malakoplakia, and Incrusted Cystitis. F. H. Redewill. J. A. M. A., 92:532-536, Feb. 16, '29.

Of the two cases of incrusted cystitis, two cases of leukoplakia of the bladder and one case of vesical malakoplakia here reported, two cases, one of incrusted cystitis and one of leukoplakia, were Dr. Player's. To warrant a diagnosis of malakoplakia, a portion of the plaques removed should show macrophage cells nd Michaelis-Gutmann bodies.

Cases of malakoplakia are rare, only 44 cases having been reported in the literature to date, including those reported here. Eighty-eight cases of leukoplakia have been reported, whereas incrusted cystitis is of rather common occurrence.

These three infestations of the urinary bladder resemble one another in that calcium salts are deposited and there is a tendency to epidermization. The pushing of all the vitamins in the diet, and the injecting of parathyroid aid materially in the treatment of all three of these conditions. Valuable adjuncts in the treatment are the Player method of cauterizing, diathermy and ecto-antigen injections.

Malignant changes in the vesical plaques and blocking of the ureters are grave complications. However, if the lesions have not advanced to the malignant stage, even involvement of the kidneys and ureters—provided the ureters are patent, need not necessarily portend a bad prognosis, if parathyroid and vitamins are administered early with routine treatment. When parathyroid is administered, accurate determinations of the serum calcium should be made to avoid overdosage; i.e. symptoms of hypercalcemia.

A Rational Treatment of Paralysis. L. Feldman. Am. J. Physical Therapy, 4:539-544, March, '28.

Physical measures when properly applied in the treatment of a true peripheral paralysis offers the best means on hand as far as present knowledge is concerned of making an early and correct differential diagnosis and rational and successful treatment of a rather common, distressing, painful pathological condition, with reduction of complications such as severe permanent atrophy, paralysis and disfigurement.

Roentgenology in Appendicitis. A. Galambos. Med. Rev. of Rev., 398:25-38, Jan., '29.

The appendicular x-ray findings can only in conjunction with the clinical and the other data referring to the case and technic of examination, be properly interpreted. A systematically performed and correctly interpreted roentgen examination of the vermifom appendix is in cases clinically suggestive of appendicitis, of the utmost importance. The normal appendix is mostly patent and permeable, and can with the aid of a properly adapted technic very frequently be visualized. A roentgenologically visible appendix proves, *ceteris paribus*, a physiological appendix, especially if it appears on different films as freely movable.

Pathological conditions produce in most of the cases narrowing, even total obliteration of the appendicular lumen and consequently a constantly failing visualization of the appendix, in spite of a properly adapted technic, may, *ceteris paribus*, as indication of a pathological condition, be considered. The frequency of the visualization of the appendix of recent date, Aschoff's observations, concerning the frequent impermeability of the appendicular lumen in cases of acute appendicitis, Stierlin's teaching and its further application for the diseased appendix, may, among others, support the author's conception in regard the interpretation of the appendicular roentgen findings under normal and pathological conditions.

The Non-Operative Treatment of Fractures of the Upper Extremity. F. D. Dickson and R. L. Diveley. Med. Herald and Physiotherapist, 47:327-332, Dec., '28.

The best results will be obtained in the treatment of fractures by selecting a standard method for each fracture and adhering to this method so far as possible. In our experience, traction is the most useful method of treating fractures of the upper extremity with certain exceptions. Traction is applicable in most of the usual fractures of the upper extremity by using one of the efficient traction splints, which are easily procured or made.

Comparative Notes on Radon Implants. A. Soiland, W. E. Costolow and O. N. Meland. Radiology, 12:44-45, Jan., '29.

Owing to the fact that radium seeds can be purchased by anyone requiring them, many times they are employed by people unqualified and inexperienced in using them. Glass radon implants have been entirely discontinued by the authors for the use of platinum and gold filtered points, although their value in malignancy of the tongue was very great. It is difficult to correctly estimate the correct dosage for malignancy although charts and hypothetical methods prepared by men who have practically solved the method of dosage, may be referred to in this connection. There are many factors to consider in employing the use of radium implants. Gold implants are the method of choice in inaccessible areas while the removable platinum implants are indicated in accessible areas. The possiblity of a later reccurrence of the malignancy must be borne in mind when employing implants. Malignancies of the tongue, floor of the mouth and inner cheek are best treated by metallic implants. However, lesions of the plate respond more satisfactorily to electrocoagulation. Bladder malignancies are best treated by filtered implants, in those of the rectum, metallic implants are indicated. The author criticizes the too prevalent use of radium implants by untrained men.

The Present Status of X-Ray Therapy of the Tonsils. Herman Fried. Med. J. and Rec., 129:23-26, Jan., '29.

It is a well known fact that lymphoid tissue is very sensitive to x-rays and radium. This is one of the main reasons that these two agents are indicated in treatment of the tonsils and adenoids. It is generally conceded that all cases of chronic tonsillitis can be successfully treated by x-ray except bad fibrous tonsils. There are no dangers nor ill effects during or following tonsil radiation. Those cases of tonsillitis where tonsillectomy is contra-indicated are those which should receive radiation.

Analgesic Propertis of the X-ray. L. J. Carter. Radiology, 12:27-34, Jan., '29.

The conclusions drawn from this series are based on an experience with 115 cases, in which a total of 950 individual treatments have been admininstered. The treatments have not in the majority of cases been given only for the relief of pain. There has always been a two-fold objective in view—to relieve pain and to correct the disease lying behind it. The objective, as far as relief of pain is concerned, has been almost invariably attained. The removal of the underlying cause has been accomplished in a degree sufficient, in cooperation with other well-recognized therapeutic prodcdures to warrant its use as a routine therapeutic agent in the diseases noted. The writer hopes that his re-emphasis on the analgesic properties of the x-ray will stimulate radiologists, and, through them, the general medical profession with whom they consult, to give to their patients the great advantages which accrue through the use of the x-ray as a therapeutic measure in the control of pain.

The Mechanical Explanation of the Biological Action of Radiation. S. Brown. Radiology, 11:466-469, Dec., '28.

It is a universal fact that the resistance of a body depends upon its heat capacity. The more heat a body possesses the less its resistance. The living tissue, normal or abnormal, is no exception to this rule. It has been shown that the heat capacities of tissues vary, and this depends upon the water content, while this in turn depends upon the proportion of cells to intercellular material. By a simple method it has been shown that the heat capacities can be estimated and thus their resistance established. It now becomes evident why certain tissues, normal or abnormal, are more susceptible to radiation than others. It is the

tissue which is highly cellular, and therefore, of a high heat capacity, that yields so readily to radiation of a certain quantity and not to the quality of the radiation.

Treatment of Cancer of the Cervix. C. D. Donaldson. Radiology, 12:154-156, Feb., '29.

There is no doubt that incidence of cancer is increasing and there is a doubt in the minds of some if it is curable in any stage. Conditions which subject the tissues to chronic irriation in the cervix are precancerous factors. Surgery, electrocoagulation, x-ray and radium are all methods of treating and destroying this malignancy. Cancer of the cervix is very rarely seen until it has developed to quite a large extent. Schmitz of Chicago classifies the stages of this condition into four groups, ranging from the primary nodule to the extensive ulceration. Of the first two groups, a simple hysterectomy is advocated, in the third and fourth, x-ray and radium. The preparation of the patient, position for treatment and method of applying the radium are described.

Zinc Ionization in the Treatment of Purulent Otitis Media. Francis B. Blackmar. J. M. A. Georgia, 17: Dec., '28.

The author employs a solution of cocaine and adrenalin to shrink and anesthetize the mucous membrane before instituting the zinc ionization method. The results of several otologists are noted. The difference in results is explained in the thoroughness or lack of thoroughness in cleaning the ear, not forgetting the attic, before attempting treatment, and the selection of suitable cases. In the literature on the subject the effect of zinc ionization on chronic otitis media alone is mentioned. The author suggests the method for acute otitis media and cites cases in which he has used it. In general it is contended that the effect of the treatment is two fold. There is a disinfecting effect and a shrinking effect on the mucous membrane. Attention is directed also to the value of zinc ionization for ears which continue to discharge after mastoidectomy. It serves also as a therapeutic test in aiding to determine just when a mastoidectomy is necessary to cure a discharging ear. In spite of restrictions, Blackmar feels that his results have been good with very few exceptions.

A New Method of Treating Eczema in Children by Ultraviolet Rays. Kurt Huldschinsky. Brit. J. Actinotherapy and Physiotherapy, 3: Feb., '29.

The treatment of acute eczema with ultraviolet radiation has heretofore been unsuccessful. To be effective ultraviolet therapy must comply with two demands. 1. "The rays must be of sufficient intensity to be efficacious on non-reacting tissue. 2. "To prevent them causing irritation to an already inflamed tissue." The author has observed that by utilizing a photosensitive agent, such as *silver nitrate,* the affected area becomes more highly sensitive to ultraviolet rays. An immediate tanning effect is produced by virtue of deposition of silver ion molecules on the tissue and a quick union of these ions with the protein tissue ensues. The penetration of the rays is limited only to the area painted over by the silver nitrate solution and its danger of deeper penetration is prevented by the associated barrier of pigment formation. The technic is to paint the eczematous patch with a 2-3% solution of silver nitrate (in adults 5%) screening off the rest of the body by a cloth covering or sterile ointment. Distance of lamp to patient 20-6 inches. "The distance only influences the rapidity of the tanning process, it has no relation to the healing." After a few minutes a blackening or tanning is noticed and the desired effect is completed in from one to five minutes. At the end the whole area becomes black and dry. Itching ceases immediately after the treatment, and the part becomes scaly and peels off. The excoriated portion is covered with a new growth of a scab and skin. Ordinary sunshine could also be used but the results are not so pronounced. The author has named this form of treatment the "ultraviolet Argentum method or in short the "Uvag method."

Radium Therapy of Carcinoma Uteri. Ten Years of Clinical Experience and Results at the Woman's Hospital. Geo. G. Ward. Amer. Jour. Obs. and Gynec., 17:1, 1929.

Ward believes that radium therapy is preferable in all classes of cervical carcinoma. Although radical operations of the very early cases may give the same result the associated high primary mortality and morbidity are factors for favorig the use of radium. The patient should be personally supervised by the surgeon in charge with re-examinations at regular intervals. Repeated irradiations are then given to check incipient recurrences as they are found. Ward believes that vescial and rectal fistulas will become less frequent as the technique of radium application improves. There is a need for a standardization of statistics and this report includes the author's five essentials for radium therapy statistics. The average initial dose employed at the Woman's Hospital is 2400 to 4200 milligram hours. Massive doses are not believed to be necessary.

Relation of the Altitude of the Sun to Its Antirachitic Effect. F. F. Tisdall and A. Brown. J. A. M. A., 92:860-864, March 16, '29.

A marked increase occurs in the antirachitic effect of sunshine when the sun reaches an altitude of 35 degrees or more. A study of the geographic distribution of rickets shows that rickets is uncommon or exists chiefly in a mild form in those places where the minimum seasonal altitude of the sun is not below about 35 degrees. Conversely, severe rickets is chiefly encountered in those cities where the altitude of the sun is below 35 degrees for some months of the year. The period of the year during which rickets will probably develop can be calculated for any city in the world. The duration of this period may be altered, however,

by the prevention of exposure of patients to highly effective sunshine on account of inclement spring weather or other factors.

The Collings Electrome—Its Use. C. S. Vivian and R. V. Day. Calif. & West. Med., 30:157-159, March, '29.

The Collings high frequency generator affords a machine that is indispensable if one intends to use the Collings knife. Fortunately it serves as well as any machine on the market, and better than most, for use in surgical diathermy or for destruction of pappilomatous and other growths in the bladder, through the cystoscope in the unopened bladder. The destruction of post-prostatectomy tags and small nodules, as well as the destruction of polypoid growths in the urethra at the bladder neck of either the male or female patient, is easily done through the McCarthy panendoscope with suitable electrode. The apparatus is relatively inexpensive.

Uterine Bleeding. C. F. Fluhmann. Calif. & West. Med., 30:153-157, March, '29.

A series of seventy-three patients with uterine bleeding, and in whom there were no palpable lesions in the pelvis, have been considered. A comparison of the clinical manifestations of the bleeding with the histopathological findings showed no definite relation between the two. Glandular hyperplasia of the endometrium was the lesion most frequently found, and in twenty-four cases the endometrium was essentially normal. The actual bleeding is due to local processes in the endometrium resulting from the influences of some external factor which in most instances is probably a disturbane in the function of the ovary

In the treatment of these conditions many procedures have been advocated. Several drugs and many endocrine preparations have been recommended, but on the whole the results have not been encouraging from a curative standpoint. Although a curettage does not actually cure many of these patients it should be performed as a diagnostic procedure, and it also brings temporary relief to a considerable number. Radium is the treatment of choice in "functional bleeding" at the time of the menopause, and hysterectomy must be resorted to under certain circumstances.

Case Management of Radiotherapy. M. Hoeing. Radiology, 12:249-251, March, '29.

The importance of conducting the treatment prescribed with painstaking accuracy in every detail is emphasized. The author calls attention to the responsibility carried by every technician in the conduct of radiotherapy. We should at all times be aware of the power for good or harm inherent in x-rays. Our obligation to the patient to adminsiter no harm to him is scarcely more than the obligation to the radiologist who has prescribed the therapy. Be patient, conscientious, and observing in all matters. No matter how long the day may seem nor how difficult the work has been, do not stop until there has been given to each patient the best of care. Record all technic as given and report to the radiological directors any noticeable symptom, as nausea, emesis, etc., also report any change detected in those areas receiving radiotherapy.

The Use of Gold-Filtered Radon Seeds. J. J. Duffy. Radiology, 12:93-99, Feb., '29.

The gold seed is about twice the diameter of the glass seed; the platinum removable implant is nearly three times the diameter of the glass seed. The gold and platinum seeds of 0.3 mm. filtration transmit 3.16 per cent of the total radiation transmitted by the glass seed, but the filtered implants screen out all but 8.8 per cent of caustic beta rays. Filtered implants permit the employment of a double amount of gamma radiation, for they contain twice the amount of radon that is used in glass seeds. Volume of tissue necrosis by filtered seeds is one-fifth that of glass seed, which has one-half the radon content. Filtered seeds permit of the treatment of lesions in which it is impossible to use glass seeds, and all implantations of filtered seeds, and final healing is more rapid. The gold seeds, though the same as platinum physically, are vastly superior mechanically, safer surgically, and the actual application is much less uncomfortable to the patient. They may be implanted where the use of platinum removable seeds is impossible.

Polyradiotherapy in Dermatology. W. I. Le Fevre. Radiology, 12:136-141, Feb., '29.

The use of radiant energy has revolutionized the practice of dermatology in the past decade. The author remarks only of the employment of ultraviolet and x-ray in a few dermatoses and outlines his method in giving the treatment. Sampson first advocated the combined use of ultraviolet and x-ray in his blood on "Physiotherapy technic." The author advocates the combined use of the above two factors in the following diseases: Acne rosacea, sycosis vulgaris, boils, carbuncles and pyogenic infections, tinea tonsurans, tinea barbae, favus, blastomycosis, eczematoid ringworm, eczema marginatum, seborrheic eczema, chronic indurated eczema, psoriasis, lichen planus, pruritus ani and vulvae, lupus vulgaris, lupus erythematosus and epithelioma.

New Method of Radiologic Exploration of the Appendix.

In *La Semana Med.*, Buenos Aires, Mar. 15, 1928, Dr. Cambies describes his method of using magnesium chloride solutions for the radiologic exploration of the healthy or diseased appendix, which he has employed since 1918. He has, however, recently substituted for the original solution of 10.5 Gm. of magnesium chloride the natural water of Chatel-Guyon which contains about 8 Gm. of this salt per quart.

The results reported are based upon about 1200 radiologic examinations, 115 of these being for the appendix, 40 of which were diagnosed as chronic appendicitis and confirmed by surgical operation.

A careful preparation of the patient is necessary. The intestine is evacuated by enema 3 or 4 days before the examination. During the two days before examination the patient takes, twice a day, in the morning before breakfast and in the evening between 5 and 6 o'clock, a dose of 200 cc. of warm magnesium chloride solution. In cases with pronounced intestinal stasis the patient is recommended to take 200 to 300 cc. of yoghurt two days before examination. This helps the motor-excitatory action of the magnesium chloride.

On the evening prior to the examination, the dose of magnesium chloride is incorporated in the opaque meal (the author uses barium sulphate, combined with nutritive elements, as recommended by Heudebert). The opaque meal is diluted with 100 to 150 cc. of magnesium chloride solution. This gives an opaque jelly.

Roentgen Treatment of Acute Cervical Lymphadenitis. L. Charles Rosenberg. Am. J. Dis. Child., 37:529-540, March, '29.

Roentgen therapy has been used with good results in a variety of acute infections as histologic evidence has demonstrated. Its use is warranted, therefore, in the treatment of acute cervical lymphadentis. Eighty patients were treated; sixty-eight recovered without suppuration. Acute cervical lymphadenitis is almost of prolonged duration. Roentgenization accelerates the inflammatory process, so that there is either rapid resolution or rapid breaking down. Following the exposure, there is relief of pain and discomfort, and improvement in the constitutional symptoms. Unfavorable effects do not result from irradiation. Roentgen therapy, although it reduces the need for surgical intervention to a minimum, cannot supplant it.

Ultraviolet Therapy. E. P. Cumberbatch. Brit. Med. J., July 14, '28.

Dr. E. P. Cumberbatch, London, Eng., in *Brit. Med. J.*, July 14, 1928, points out that when the practitioner exposes his patients to the ultraviolet lamp he administers some phototherapy and thermotherapy as well as ultraviolet therapy.

The ultraviolet rays with the longest wave-lengths are believed to have no chemical action on the tissues and are probably thermogenetic.

It is mainly by indirect action that the ultraviolet rays bring about therapeutic action, and this is obvious when the disease is deep-seated.

The plain carbon arc lamp emits much heat and light but the proportion of ultraviolet rays is small. The lamp which the author recommends is the mercury vapor lamp which is rich in ultraviolet but poor in heat rays.

Ultraviolet treatment may be said to be a specific for rickets, and tetany and laryngismus stridulus are said to respond equally well.

Ultraviolet treatment, either alone or in combination with other treatments, will generally effect a cure in the following diseases: marasmus, post-febrile weakness, nasal and bronchial catarrh, aural discharges, post-influenzal debility, surgical tuberculosis, lupus vulgaris, impetigo contagiosa, acne vulgaris, boils and carbuncles. The treatment should receive a trial in seborrhea, non-specific indolent ulcer, erythema pernio and pruritus ani or vulvae.

There is a large group of diseases which resist other treatments, for which ultraviolet treatment is now being tried with more or less success. These include chronic fibrositis and arthritis, pelvic infections, hyperiesi, chronic bronchitis, bronchial asthma, Raynaud's disease, etc.

Patients with general pyrexia should not receive ultraviolet therapy. In acute local infections the rays should not be applied locally, nor until pus, if present, has been evacuated. In all cases the treatment should be under the direction of a physician.

Radium and Roentgen Ray Therapy. F. Carter Wood. J. A. M. A., 92:894-897, March 16, '29.

The use of radium and the roentgen ray has unquestionably advanced the treatment of tumors of the skin and of the oral region very greatly. It has also changed the situation in regard to carcinoma of the cervix of the uterus. In most of the other types of malignant growths the results are variable and as yet unsatisfactory as regards cure. When a malignant tumor is accessible and completely removable, surgery is still the preferred method. This is true even in carcinoma of the skin and the uterine cervix, unless the services of a highly skilled roentgenologist, with adequate equipment and an ample supply of radium, are available. The use of an insufficient or improper quantity of the roentgen ray or of radium under such circumstances is nothing more than quackery

Malignancy of the Uterine Cervix and Its Treatment with Heavily Filtered, Multiple Centers of Radium: Use of New Applicator. Harold Swanberg. Radiol. Rev., 51:107-123, March, '29.

Swanberg shows quite conclusively that the surgical treatment of cervical carcinoma has been practically abandoned by the leading gynecologists of America and replaced by radiation therapy. He advocates the Regaud (Paris) technic as the best method for applying radium in this condition and describes it in detail. (Regaud is the associate of Mme. Curie and the Director of the Radium Institute of the University of Paris). The principles of the method are (1) proper preliminary treatment, (2) rigorous asepsis, (3) use of comparative small amounts of radium over a long period applying the greatest possible dosage without injury to surrounding normal tissues, (4) employment of a number of radio-active centers distributed throughout the entire uterine canal and in the vagina, (5) use of heavy filtration with dense metals which permit only the deep penetrating gamma rays of radium to be emitted thereby avoiding necrosis of the tissues, and (6) use of external radiation when the parametria is involved.

Swanberg has simplified the Regaud technic by the use of a long adjustable "T" shaped, special gold applicator for radiating the entire uterine canal and cross-firing on the cervix. This is used in connection with the Kaplan colpostat, a device for placing heavily filtered radium in the lateral vaginal fornices. The advantages claimed for the new applicator are, (1) provides a single, heavily filtered, instrument for radiating the entire uterine canal and vaginal portion of cervix thus reducing the number of applicators to two, (2) graduated parts for adjusting applicator to fit various length uterine canals, (3) offers 50% greater filtration than the Regaud applicators, (4) gives greater protection to the vagina, thus preventing fistula formation, and (5) much less expensive than applicators of platinum construction.

With the applicators the author uses, six radium centers with a total of 75 milligrams are used for 6000 to 8000 milligram hours in the average case.

Regaud's latest statistics show 72% of his patients living one year after radium treatment in spite of the fact that 88% were inoperable when first treated. In addition, 26.7% of all cases are alive and free from cancer 5 to 6 years after the radium treatment. The author concludes with the following:

"We believe the results enumerated above are very encouraging and that they can be approximated by the conscientious physician who is properly prepared to treat cervical cancer by radiation methods. They are obtained, it must be remembered, without any mortality resulting from the treatment, which cannot be said of the surgical method. The outlook for the patient with cervical cancer has therefore, been vastly improved by the introduction of radiation therapy. The simplicity and ease of applicaton of radium in uterine malignancy makes radium therapy a part of the regular physician's armamentarium, which should do much to hold out hope to many women suffering from cancer, who heretofore, have been doomed to die because the means of aiding them was not sufficiently close at hand."

The Treatment of Rickets with Ergosterol. E. T. Wilkes, D. W. Follett and E. Marples. Am. J. Dis. Child., 37:483-496, March, '29.

Twenty-four infants with rickets, varying from mild to severe forms, were successfully treated with irradiated ergosterol. Two infants with tetany were cured by irradiated ergosterol. The irradiated ergosterol, in the form of a commercial preparation, was well taken and well tolerated. Two of the patients had severe bronchopneumonia and several had previously refused or vomited cod liver oil. The commercial preparation used retained its potency for at least six months in one instance. Reports of other authors who used irradiated ergosterol are confirmed. It was found that irradiated ergosterol requires about three weeks to cause serum blood phosphorus and calcium concentration to return to normal, about the same time for x-ray signs of healing of the bones to appear, and about six weeks for complete healing. These averages compare favorably with those obtained with cod liver oil, quartz light and egg.

Crainotabes was healed within an average of one month in our series of twelve patients. In individual cases a period of from twelve days to eight weeks was required. Healing of the rachitic bone took place in one patient with bronchopneumonia, despite a low serum phosphorus and calcium produce of 20.5 mg. per hundred cubic centimeters. Caution may be necessary in using irradiated ergosterol in patients with tetany who show a high blood phosphorus content. Irradiated ergosterol is not a perfect preventative for rickets. Crainotabes developed in one patient receiving prophylactic doses of irradiated ergosterol. This healed promptly when the ergosterol was continued in unchanged amounts.

The Value of Different Types of Glass for Transmitting Ultraviolet Light. E. T. Wyman, A. D. Holmes, L. W. Smith, D. C. Stockbarger and Madeline G. Pigott. Dis. of Child., 37:473-482, March, '29.

It appears from the growth curves, the calcium and phosphorus content of the blood serum, the roentgenograms, the pathologic studies and the ash content of the bones that practically as much ultraviolet light passes through Corning glass as is obtained by direct irradiation. Vitaglass, on the other hand, permits the passage of only a certain fraction of the necessary ultraviolet rays. Ordinary window glass may be considered virtually useless in this respect, owing to the fact the animals irradiated under this type of glass showed practically as marked a degree of rickets as those which did not receive any irradiation.